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A Purchasing Guide for Engineers, Contractors, Public
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For Directory of Consulting Engineers See Pages 91-93

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Where to Purchase

A comprehensive Directory of the leading machinery and supply manufacturers arranged for the convenience of contractors, engineers, water-works superintendents, municipal and county engineering departments, street and highway officials, city managers, etc., and public officials who may desire to secure catalogs or prices on construction equipment. Where the name of a manufacturer is preceded by a star (*) it indicates that the user of the directory may secure further information by referring to the manufacturer's advertisement in this issue. The index to advertisers will be found on page facing the inside back cover.

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ACETYLENE APPARATUS

Air Reduction Sales Co., New York.

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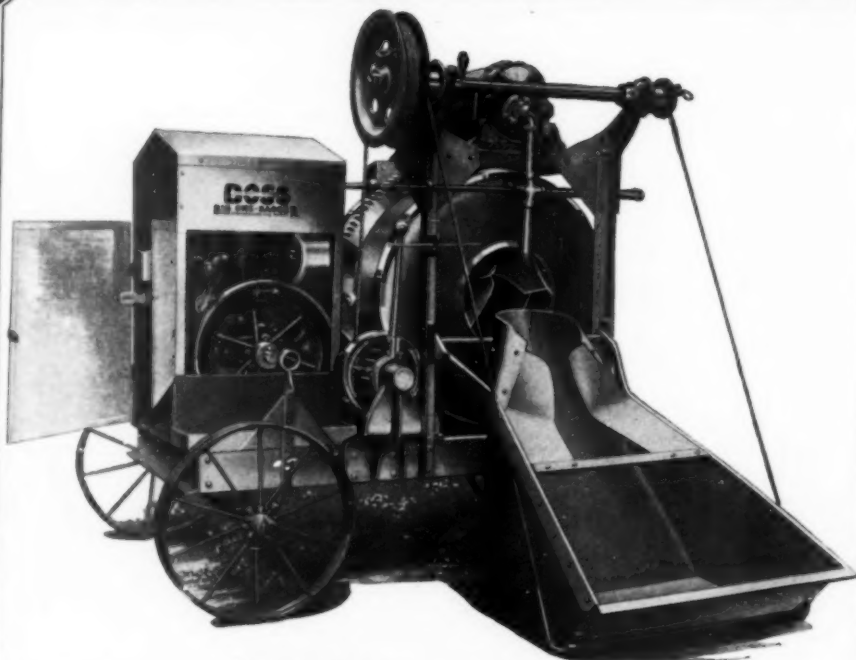
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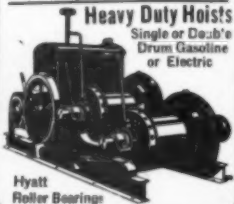


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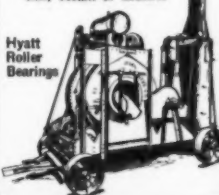
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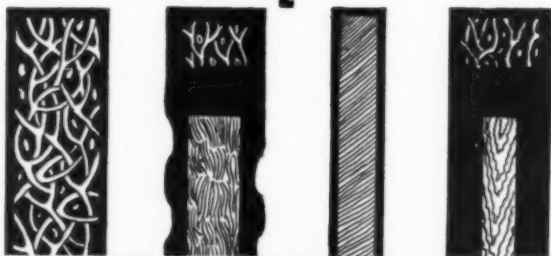
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Servicised Expansion Joints



MONITORS OF THE ROAD

Old principles of expansion joint provide fillers of solid asphaltic content or impregnated fibre and asphalt in an elastic mass. ¶ The fundamental purpose of the filler is to re-occupy the space left by two contracting slabs. ¶ Solid asphaltic or impregnated fibrous materials contract, concrete slabs likewise contract on cooling. ¶ Three contracting bodies cannot occupy the same space as when expanded. Servicised Joints expand when the concrete slabs contract. ¶ This is the key to a permanent waterproof joint; a correct answer to the problem of expansion between two contracting bodies. Unimpregnated cellular fibrous matter in Servicised Joints brings about this re-expansion after compression is relieved.

Trapped Under Compression: The print to the right is an example of oozing under compression. Due to the hard asphalt surfacing over the concrete base, the traffic could not carry the surplus away because it was locked in between the asphalt surfacing and base. The force was great enough, however, to form bulges in the hard asphalt surface.



A Bituminous and Impregnated Fibre or Elastic Mass: No better proof of indiscriminate oozing. No better illustration of the need of expansion joint of the proper kind. The action in this instance resembles that of paste in a tube being squeezed with one side open. Action of this kind causes tremendous waste, without resulting in good. Servicised Joints will prevent this.

Write Us About Your
Expansion Joint
Problems

Servicised Products Co.
First National Bank Bldg.
CHICAGO



TYPE B
75% Bitumen
25% Cellular Fibre



TYPE D
Self-Expanding
Non-Raising



TYPE C
Felt Center—Coastal
Sides—Sidewalk Joint



TYPE AA
3/16 Veneer Core

Four Types of Servicised Expansion Joints



in Which the Oozing Tendency Is Controlled

Servicise the Crevice and Save the Road

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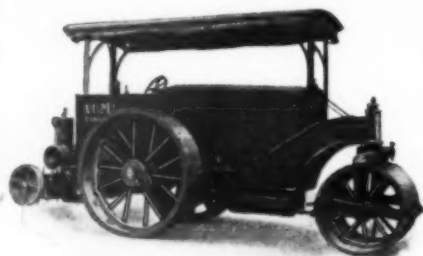
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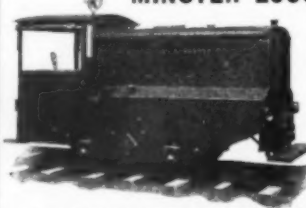
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Lakewood Engineering Co., Cleveland, Ohio.
Marsh-Capron Co., Chicago, Ill.
Ransome Concrete Machy. Co., Dunellen, N. J.
Standard Scale & Supply Co., Pittsburgh, Pa.

MOTORCYCLES
Cleveland Motorcycle Co., Cleveland, Ohio.
Harley-Davidson Motor Co., Milwaukee, Wis.
Hendee Mfg. Co., Springfield, Mass.

MOTORS, ELECTRIC
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Cruicker-Wheeler Co., Amherst, N. J.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Holtzer-Cabot Elec. Co., Boston, Mass.
Lincoln Elec. Co., Cleveland, O.
Robbins & Myers Co., Springfield, O.
Wagner Elec. Mfg. Co., St. Louis, Mo.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

MOTORS, GASOLINE
Buda Co., Harvey, Ill.
Climax Engineering Co., Clinton, Ia.
Continental Motors Corp., Detroit, Mich.
Herschell-Spillman Co., Tonawanda, N. Y.
Hinkley Motors, Inc., Detroit, Mich.
Van Blerck Motor Co., Monroe, Mich.
Waukesha Motor Co., Waukesha, Wis.
Wisconsin Motor Mfg. Co., Milwaukee, Wis.

MOTOR TRUCKS
*General Motors Truck Co., Pontiac, Mich.
Acason Motor Truck Co., Detroit, Mich.
Acme Motor Truck Co., Cadillac, Mich.
All American Truck Co., Chicago, Ill.
Atterbury Motor Car Co., Buffalo, N. Y.
Avery Co., Peoria, Ill.
Autocar Co., Ardmore, Pa.
Bessemer Motor Truck Co., Grove City, Pa.
Brookway Motor Truck Co., Cortland, N. Y.
Clydesdale Motor Truck Co., Clyde, O.
Corbitt Motor Truck Co., Henderson, No. Car.
Denby Motor Truck Co., Detroit, Mich.
Diamond T. Motor Car Co., Chicago, Ill.
Duplex Truck Co., Lansing, Mich.
Federal Motor Truck Co., Detroit, Mich.
Four Wheel Drive Auto Co., Clintonville, Wis.
Garford Motor Truck Co., Lima, O.
Gramm Bernstein Motor Truck Co., Lima, O.
Indiana Truck Corp'n., Marion, Ind.
International Harvester Co., Chicago, Ill.
International Motor Co., New York.
Kelly Springfield Motor Truck Co., Springfield, O.
Kissel Motor Car Co., Hartford, Wis.
Larrabee-Deyo Motor Tr. Co., Binghamton, N. Y.
Nash Motors Co., Kenosha, Wis.
Oshkosh Truck Sales & Finance Corp., Oshkosh, Wis.
Packard Motor Car Co., Detroit, Mich.
Pierce Arrow Motor Car Co., Buffalo, N. Y.
Republic Motor Truck Co., Alma, Mich.
Rowe Motor Mfg. Co., Lancaster, Pa.
Selden Truck Corp'n., Rochester, N. Y.
Service Motor Truck Co., Wabash, Ind.
Sterling Motor Truck Co., Milwaukee, Wis.
Stewart Motor Corp'n., Buffalo, N. Y.
Tiffin Wagon Co., Tiffin, O.
Titan Motor Truck Co., Milwaukee, Wis.
Traffic Motor Truck Co., St. Louis, Mo.
Transport Truck Co., Mt. Pleasant, Mich.
U. S. Motor Truck Co., Cincinnati, O.
Velle Motors Corp'n., Moline, Ill.
Ward LaFrance Truck Co., Elmira, N. Y.
Watson Products Corp'n., Canastota, N. Y.
Wilson Co., J. C., Detroit, Mich.
White Co., Cleveland, Ohio.
Winther Motors, Inc., Kenosha, Wis.

MOULDS, CONCRETE
Blaw-Knox Co., Pittsburgh, Pa.
Hydraulic Steelcraft Co., Cleveland, O.

OAKUM
Wall Rope Works, Beverly, N. J.

OILS, ROAD
*Barber Asphalt Co., Philadelphia, Pa.
*Pioneer Asphalt Co., Lawrenceville, Ill.
*Standard Oil Co. (Indiana), Chicago, Ill.
*Texas Company, New York.
Atlantic Refining & Asphalt Corp'n., Philadelphia
Barrett Co., New York.
Headley Good Roads Co., Philadelphia, Pa.
Pierce Oil Corp., New York.
Sinclair Refining Co., Chicago, Ill.

Standard Oil Co., (La.) New Orleans, La.
Standard Oil Co., (N. J.) Newark, N. J.
U. S. Asphalt Paving Co., New York.
OXY-ACETYLENE APPARATUS
Oxweld Acetylene Co., Newark, N. J.

OXYGEN
Linde Air Products Co., New York.

PACKING, WATER PIPE
*Union Water Meter Co., Worcester, Mass.
Leadite Co., The, Philadelphia, Pa.
United Lead Company, New York.

PAINTS, METAL PROTECTION
*Barber Asphalt Co., Philadelphia, Pa.
*Dixon Crucible Co., Jersey City, N. J.
*Truscon Laboratories, Detroit, Mich.
Acme White Ld. & Col. Works, Detroit, Mich.
Barrett Co., New York.
Berry Bros., Detroit, Mich.
Cook Paint & Varnish Co., Kansas City, Mo.
Detroit Graphite Co., Detroit, Mich.
Detroit White Lead Wks., Detroit, Mich.
Du Pont de Nemours & Co., Inc., E. I., Wilmington, Del.
Longman & Martinez, New York.
Martin-Senour Co., Chicago, Ill.
Minwax Co., New York.
Protexol Corp'n., New York.
Ruberoid Co., New York.
Semet-Solvay Co., Syracuse, N. Y.
Sherwin-Williams Co., Cleveland, O.
Sonneborn Sons, Inc., L., New York.
Toca Bros., New York.
Tropical Paint & Oil Co., Cleveland, Ohio.
Truscon Laboratories, Detroit, Mich.

PAPERS, BLUE PRINT AND BROWN PRINT
Indianapolis Blue Print & Supply Co., Indianapolis, Ind.

PAPER, BUILDING, ROOFING, ETC.
*Barber Asphalt Co., Philadelphia, Pa.
*Carey Co., Philip, Cincinnati, O.
Barrett Co., New York.
Bird & Son, Inc., E. Walpole, Mass.
Brown Co., Portland, Me.
Hydrex Asphalt Products Corp., New York.
Johns-Manville, Inc., New York.
National Roofing Co., Tonawanda, N. Y.
Ruberoid Co., New York.

PARK BENCHES
Art Concrete Works, Pasadena, Calif.
Bausman Mfg. Co., Bausman, Pa.
Dow Co., Louisville, Ky.
Mott Iron Wks., J. L., New York.
Stewart Iron Works, Cincinnati, Ohio.

PAVING AND ROAD ROLLERS (See Road and Paving Rollers)

PAVING BLOCKS, CREOSOTED WOOD
American Creosote Wks., Inc., New Orleans, La.
Creosoted Materials Co., New Orleans, La.
Jennison-Wright Co., Toledo, O.
Republic Creosoting Co., Indianapolis, Ind.
Wyckoff Pipe & Creosoting Co., New York.

PAVING BRICK
Alton Brick Co., Alton, Ill.
Barr Clay Co., Sreator, Ill.
Binghamton Brick Co., Binghamton, N. Y.
Burton Townsend Co., Zanesville, O.
Flint Brick Co., Des Moines, Ia.
Hydraulic Press Brick Co., St. Louis, Mo.
McAvoy Vit. Brick Co., Philadelphia, Pa.
Mack Mfg. Co., Wheeling, W. Va.
Mayer Brick Co., C. P., Bridgeville, Pa.
Medal Paving Brick Co., Cleveland, O.
Metropolitan Paving Brick Co., Canton, O.
Murphyshoro Paving Brick Co., Murphyshoro, Ill.
Patton Clay Mfg. Co., Patton, Pa.
Peebles Brick Co., Portsmouth, O.
Penna. Clay Co., Pittsburgh, Pa.
Pittsburgh Paving Brick Co., Pittsburgh, Pa.
Poston Paving Brick Co., Crawfordsville, Ind.
Purinton Paving Brick Co., Galesburg, Ill.
Southern Clay Mfg. Co., Chattanooga, Tenn.
Sterling Brick Co., Olean, N. Y.
Thurber Brick Co., Thurber, Texas.
Veederhurg Paver Co., Veederhurg, Ind.

PAVING MACHINERY (See Road and Paving Machinery)

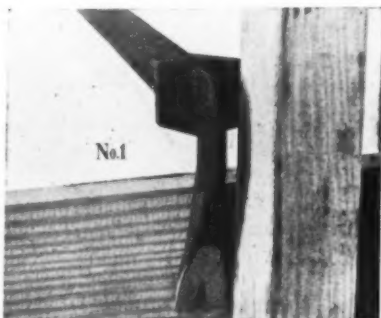
PAVING GUARDS, STEEL
Godwin Co., W. S., Baltimore, Md.
International Steel Tie Co., Cleveland, O.

PAVING MATERIALS (See "Asphalt," "Paving Brick," "Granite Block," etc.)

PAVING MIXERS. (See Concrete Mixers)

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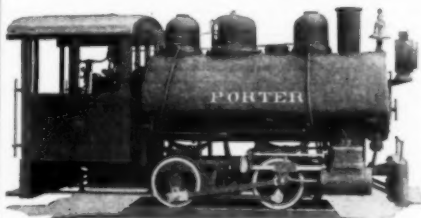
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- *Connelly & Co., Inc., Philadelphia, Pa.
- *Littleford Bros. Co., Cincinnati, O.
- Warren Bros. Co., Boston, Mass.
- Anderson Tool & Snp. Co., W. H., Detroit, Mich.
- Cummer & Sons Co., F. D., Cleveland, O.
- Kramer Bros. Fdry. Co., Dayton, O.
- Union Iron Works, Hoboken, N. J.

PERFORATED METALS

- Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- Hendrick Mfg. Co., Carbondale, Pa.

PICKS

- Hubbard Co., Pittsburgh, Pa.
- Iron City Tool Works, Pittsburgh, Pa.
- Klein-Logan Co., Pittsburgh, Pa.
- Verona Tool Works, Verona, Pa.
- Warren Tool & Forge Co., Warren, O.
- Warwood Tool Co., Wheeling, W. Va.
- Wyoming Shovel Wks., Wyoming, Pa.

PILE DRIVERS

- *McKernan-Terry Drill Co., New York.
- Browning Co., Cleveland, O.
- Clyde Iron Works Sales Co., Duluth, Minn.
- Industrial Works, Bay City, Mich.
- Lidgerwood Manufacturing Co., New York.
- Mead-Morrison Mfg. Co., E. Boston, Mass.
- McMyler Interstate Co., Cleveland, O.
- Union Iron Works, Hoboken, N. J.

PILE HAMMERS, STEAM

- *McKernan-Terry Drill Co., New York.
- Clyde Iron Works Sales Co., Duluth, Minn.
- Industrial Works, Bay City, Mich.
- National Hoisting Eng. Co., Harrison, N. J.
- Union Iron Works, Hoboken, N. J.
- Vulcan Iron Works, Chicago, Ill.

PILING, CONCRETE

- MacArthur Concrete Pile & Foundation Co., N. Y.
- Raymond Concrete Pile Co., New York.

PILING, INTERLOCKING STEEL

- Carnegie Steel Co., Pittsburgh, Pa.
- Jones & Laughlin Steel Co., Pittsburgh, Pa.
- Lackawanna Steel Co., Buffalo, N. Y.

PIPE, CAST IRON

- *Central Foundry Co., New York.
- *U. S. Cast Iron Pipe & Fdy. Co., Burlington, N. J.
- American Cast Iron Pipe Co., Birmingham, Ala.
- Crow & Sons, J. B., Chicago, Ill.
- Donaldson Iron Co., Emaus, Pa.
- Fox & Co., John, New York.
- Glamorgan Pipe & Fdry. Co., Lynchburg, Va.
- Lynchburg Foundry Co., Lynchburg, Va.
- National Cast Iron Pipe Co., Birmingham, Ala.
- Warren Fdry. & Machine Co., New York.
- Wood & Co., R. D., Philadelphia, Pa.

PIPE, CULVERT (See Culverts)

PIPE, LEAD

- United Lead Company, New York

PIPE, REINFORCED CONCRETE

- Concrete Products Co., Pittsburgh, Pa.
- Core Joint Concrete Pipe Co., Baltimore, Md.
- Independent Concrete Pipe Co., Indianapolis, Ind.
- Lock Joint Pipe Co., E. Orange, N. J.
- Massey Concrete Products Corp'n, Chicago, Ill.
- United Concrete Pipe Co., New York.

PIPE, RIVETED STEEL

- *Connelly & Co., Inc., Philadelphia, Pa.
- *Littleford Bros. Cincinnati, Ohio.
- Abendroth & Root Mfg. Co., Newburgh, N. Y.
- American Spiral Pipe Works, Chicago, Ill.
- Blaw-Knox Co., Pittsburgh, Pa.
- Canton Culvert & Sile Co., Canton, O.
- Chatta Boiler & Tank Co., Chattanooga, Tenn.
- Chicago Bridge & Iron Works, Chicago, Ill.
- East Jersey Pipe Co., New York.
- Hammond Iron Works, Warren, Pa.
- Hardesty Mfg. Co., R., Denver, Col.
- Honhorst Co., Jos., Cincinnati, Ohio.
- Lancaster Iron Works, Lancaster, Pa.
- Petroleum Iron Works Co., Sharon, Pa.
- Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
- Tipton & Wood, Phillipsburg, N. J.
- Weller Mfg. Co., Chicago, Ill.

PIPE, SPIRAL RIVETED

- Abendroth & Root Mfg. Co., Newburgh, N. Y.
- American Spiral Pipe Works, Chicago, Ill.
- Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.

PIPE STEEL

- East Jersey Pipe Co., New York.
- Jones & Laughlin Steel Co., Pittsburgh, Pa.
- National Tube Co., Pittsburgh, Pa.

- Reynolds Iron & Steel Co., Youngstown, O.
- Steel & Tube Co. of Am., Chicago, Ill.
- Youngstown Sheet & Tube Co., Youngstown, O.

PIPE, WOOD

- American Wood Pipe Co., Tacoma, Wash.
- Continental Pipe Mfg. Co., Seattle, Wash.
- Michigan Pipe Co., Bay City, Mich.
- Pacific Tank & Pipe Co., San Francisco, Cal.
- Redwood Mfrs. Co., San Francisco, Cal.
- Standard Wood Pipe Co., Williamsport, Pa.
- Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE, WROUGHT IRON

- Byers Co., A. M., Pittsburgh, Pa.
- Reading Iron Co., Reading, Pa.

PIPE BENDING MACHINES

- Amer. Pipe Bending Mach. Co., Boston, Mass.
- Waiworth Mfg. Co., Boston, Mass.

PIPE COVERING

AIRCELL

- *Carey Co., Philip, Cincinnati, O.
- Ehret Magnesia Mfg. Co., Valley Forge, Pa.
- Johns-Manville, Inc., New York.
- Kearbey & Mattison Co., Ambler, Pa.
- Nat'l Asbestos Co., Jersey City, N. J.
- Norristown Magnesia & Asbestos Co., Norristown, Pa.
- Sall Mt. Co., Chicago, Ill.
- Watson Co., H. F., Erie, Pa.

85 PER CENT MAGNESIA

- *Carey Co., Philip, Cincinnati, O.
- Ehret Magnesia Co., Valley Forge, Pa.
- Johns-Manville, Inc., New York.
- Kearbey & Mattison Co., Ambler, Pa.

WOOD

- Continental Pipe Mfg. Co., Seattle, Wn.
- Redwood Mfrs. Co., San Francisco, Cal.
- Ric-Wil Co., Cleveland, O.
- Wyckoff & Son Co., A., Elmira, N. Y.

PIPE CUTTERS. (See Cutters, Pipe, Hand.)

PIPE FITTINGS

- *Central Foundry Co., New York.
- *U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.
- American I. Pipe Co., Birmingham, Ala.
- Builders Iron Fdry, Providence, R. I.
- Crow & Sons, J. B., Chicago, Ill.
- Crane Co., Chicago, Ill.
- Lunkenheimer Co., Cincinnati, O.
- Reading Steel Casting Co., Bridgeport, Conn.
- Warren Fdry. & Mach. Co., New York.
- Wood & Co., R. D., Philadelphia, Pa.

PIPE HANDLING MACHINERY

- Mueller Mfg. Co., H., Decatur, Ill.
- Taylor Portable Steel Derrick Co., Chicago, Ill.

PIPE JOINT COMPOUND. (Sewer)

- *Carey Co., Philip, Cincinnati, O.
- *Waring-Underwood Co., Philadelphia, Pa.
- G. K. Sales Co., Macungie, Pa.
- Leadite Company, Inc., Philadelphia, Pa.
- Pacific Flush Tank Co., Chicago, Ill.
- Ruberoid Co., New York.

PIPE JOINT MATERIAL. (Cast Iron)

- Lead-Hydro-Tite Co., Boston, Mass.
- Leadite Co., The, Philadelphia, Pa.
- United Lead Co., New York.

PLAYGROUND APPARATUS

- American Playground Device Co., Anderson, Ind.
- Eureka Mfg. Co., Sandusky, O.
- Everwear Mfg. Co., Springfield, O.
- George, Howard, Philadelphia, Pa.
- Hill Standard Co., Anderson, Ind.
- Medart Mfg. Co., Fred., St. Louis, Mo.
- Spalding & Bros., A. G., Chicopee, Mass.

PLOWS, CONTRACTORS

- *Austin-Western Rd. Mach. Co., Chicago, Ill.
- *Holt Mfg. Co., Peoria, Ill.
- American Steel Scraper Co., Sidney, O.
- Avery Co., Peoria, Ill.
- Burch Plow Works Co., Crestline, O.
- Deere & Co., Moline, Ill.
- Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
- International Harvester Co., Chicago, Ill.
- Moline Plow Co., Moline, Ill.
- Oliver Chilled Plow Works, South Bend, Ind.
- Russell Grader Mfg. Co., Minneapolis, Minn.
- Sidney Steel Scraper Co., Sidney, O.
- Slusser-McLean Scraper Co., Sidney, O.
- Smith & Sons Mfg. Co., Kansas City, Mo.
- Western Wheeled Scraper Co., Aurora, Ill.
- Ward Plow Co., Batavia, N. Y.

PLUMBING SUPPLIES

- Crow & Sons, J. B., Chicago, Ill.
- Crane Co., Chicago, Ill.

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CONVEYORS



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and SPRINKLERS

Municipal Supply Company
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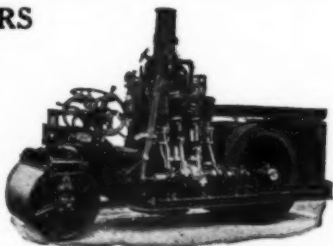
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 Walworth Mfg. Co., Boston, Mass.
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 Blaw-Knox Co., Pittsburgh, Pa.
 Electric Railway Equipment Co., Cincinnati, O.
 Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
- PORTABLE BUILDINGS**
 *Littleford Bros., Cincinnati, Ohio.
 *Truscon Steel Co., Youngstown, O.
 Blaw-Knox Co., Pittsburgh, Pa.
 Milwaukee Corrugating Co., Milwaukee, Wis.
 Pruden Co., C. D., Baltimore, Md.
- PORTABLE STEEL DERRICKS.** (See Derricks, Steel Portable.)
- PORTLAND CEMENT.** (See Cement.)
- POWDER.** (See Explosives.)
- PUMPS, AIR LIFT**
 Harris Air Pump Co., Indianapolis, Ind.
 Indiana Air Pump Co., Indianapolis, Ind.
 Ingersoll-Rand Co., New York.
 Sullivan Machinery Co., Chicago, Ill.
- PUMPS, BOILER FEED**
 Advance Pump & Compr. Co., Battle Creek, Mich.
 Allis-Chalmers Mfg. Co., Milwaukee, Wis.
 American Steam Pump Co., Battle Creek, Mich.
 Aurora Pump & Mfg. Co., Aurora, Ill.
 Buffalo Steam Pump Co., Buffalo, N. Y.
 Cameron Steam Pump Works, A. S., New York.
 Dayton-Dowd Co., Quincy, Ill.
 Dean Bros. Steam Pump Wks., Indianapolis, Ind.
 De Laval Steam Turbine Co., Trenton, N. J.
 Deming Co., Salem, O.
 Fairbanks, Morse & Co., Chicago, Ill.
 Gardner Governor Co., Quincy, Ill.
 Goulds Mfg. Co., Seneca Falls, N. Y.
 Indiana Air Pump Co., Indianapolis, Ind.
 Lea-Courtenay Co., Newark, N. J.
 Midwest Engine Co., Indianapolis, Ind.
 Morris Machine Works, Baldwinville, N. Y.
 Murray Iron Works Co., Burlington, Ia.
 Northern Fire Apparatus Co., Minneapolis, Minn.
 Scranton Pump Co., Scranton, Pa.
 Union Steam Pump Co., Battle Creek, Mich.
 Vogt Bros. Mfg. Co., Louisville, Ky.
 Warren Steam Pump Co., Warren, Mass.
 Weisman Pump Mfg. Co., Columbus, O.
 Yeomans Bros. Co., Chicago, Ill.
- PUMPS, CENTRIFUGAL**
 *Keystone Driller Co., Beaver Falls, Pa.
 Allis-Chalmers Mfg. Co., Milwaukee, Wis.
 American Well Works, Aurora, Ill.
 Aurora Pump & Mfg. Co., Aurora, Ill.
 Cameron Steam Pump Works, A. S., New York.
 Dayton-Dowd Co., Quincy, Ill.
 De Laval Steam Turbine Co., Trenton, N. J.
 Domestic Eng. & Pump Co., Shippensburg, Pa.
 Erie Pump & Engine Works, Medina, N. Y.
 Evinsrud Motor Co., Milwaukee, Wis.
 Fairbanks, Morse & Co., Chicago, Ill.
 Goulds Mfg. Co., Seneca Falls, N. Y.
 Indiana Air Pump Co., Indianapolis, Ind.
 Lea-Courtenay Co., Newark, N. J.
 Manistee Iron Wks., Manistee, Mich.
 Midwest Engine Co., Indianapolis, Ind.
 Morris Machine Works, Baldwinville, N. Y.
 Schramm, Inc., West Chester, Pa.
 United Iron Works, Kansas City, Mo.
 Wheeler Condenser & Eng. Co., Carteret, N. J.
 Worthington Pump & Machy. Corp., New York.
 Yeomans Bros. Co., Chicago, Ill.
- PUMPS, CONTRACTORS'**
 *C. H. & E. Mfg. Co., Milwaukee, Wis.
 *Smith Co., T. L., Milwaukee, Wis.
 Allis-Chalmers Mfg. Co., Milwaukee, Wis.
 American Well Works, Aurora, Ill.
 Aurora Pump & Mfg. Co., Aurora, Ill.
 Barnes Mfg. Co., Mansfield, O.
 Cameron Steam Pump Works, A. S., New York.
 Carter Co., Ralph B., New York.
 Construction Mach'y Co., Waterloo, Ia.
 Dayton-Dowd Co., Quincy, Ill.
 Deming Co., Salem, Ohio.
 Domestic Engine & Pump Co., Shippensburg, Pa.
 Emerson Pump & Valve Co., Alexandria, Va.
 Erie Pump & Engine Works, Medina, N. Y.
 Evinsrud Motor Co., Milwaukee, Wis.
 Fairbanks, Morse & Co., Chicago, Ill.
 Goulds Mfg. Co., Seneca Falls, N. Y.
 Lea-Courtenay Co., Newark, N. J.
- McGowan Co., J. R., Cincinnati, O.
 Midwest Engine Co., Indianapolis, Ind.
 Morris Machine Works, Baldwinville, N. Y.
 New York Eng. Co., New York.
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 Novo Engine Co., Lansing, Mich.
 Pulsometer Steam Pump Co., New York.
 Schramm, Inc., West Chester, Pa.
 Standard Scale & Supply Co., Pittsburgh, Pa.
 Universal Motor Co., Oshkosh, Wis.
 Van Noyhuy Machine Wks., Albany, N. Y.
 Waldo Bros. & Bond Co., Boston, Mass.
- PUMPS, DEEP WELL**
 *Clark Co., H. W., Mattoon, Ill.
 *Keystone Driller Co., Beaver Falls, Pa.
 Aldrich Pump Co., Allentown, Pa.
 American Well Works, Aurora, Ill.
 Cameron Steam Pump Works, A. S., New York.
 Cook, Inc., A. D., Lawrenceburg, Ind.
 Deming Co., Salem, O.
 Fairbanks, Morse & Co., Chicago, Ill.
 Goulds Mfg. Co., Seneca Falls, N. Y.
 Harris Air Pump Co., Indianapolis, Ind.
 Indiana Air Pump Co., Indianapolis, Ind.
 Layne & Bowler Co., Memphis, Tenn.
 Midwest Engine Co., Indianapolis, Ind.
 Nordberg Mfg. Co., Milwaukee, Wis.
 United Iron Works, Kansas City, Mo.
 Weber Subterranean Pump Co., New York.
- PUMPS, DREDGING**
 Aldrich Pump Co., Allentown, Pa.
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 American Well Works, Aurora, Ill.
 Aurora Pump & Mfg. Co., Aurora, Ill.
 Buffalo Steam Pump Co., Buffalo, N. Y.
 Cameron Steam Pump Wks., A. S., New York.
 Erie Pump & Engine Co., Medina, N. Y.
 Morris Machine Works, Baldwinville, N. Y.
 Rumsey Pump Co., Ltd., Seneca Falls, N. Y.
 Wood & Co., R. D., Philadelphia, Pa.
 Worthington Pump & Machy. Corp., New York.
- PUMPS, GASOLINE AND OIL**
 *Kinney Mfg. Co., Boston, Mass.
 Bowser & Co., Inc., S. F., Fort Wayne, Ind.
 Northern Fire App. Co., Minneapolis, Minn.
 Wayne Tank & Pump Co., Fort Wayne, Ind.
 Worthington Pump & Mach. Corp., New York.
- PUMPS, POWER**
 *Kinney Mfg. Co., Boston, Mass.
 *Koehring Co., Milwaukee, Wis.
 Alamo Iron Works, San Antonio, Tex.
 Allis-Chalmers Mfg. Co., Milwaukee, Wis.
 American Steam Pump Co., Battle Creek, Mich.
 American Well Works, Aurora, Ill.
 Aurora Pump & Mfg. Co., Aurora, Ill.
 Barnes Mfg. Co., Mansfield, O.
 Dayton-Dowd Co., Quincy, Ill.
 De Laval Steam Turbine Co., Trenton, N. J.
 Deming Co., Salem, O.
 Domestic Eng. & Pump Co., Shippensburg, Pa.
 Evinsrud Motor Co., Milwaukee, Wis.
 Fairbanks, Morse & Co., Chicago, Ill.
 Gardner Governor Co., Quincy, Ill.
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 Goulds Mfg. Co., Seneca Falls, N. Y.
 Indiana Air Pump Co., Indianapolis, Ind.
 Lawrence Machine Co., Lawrence, Mass.
 Lea-Courtenay Co., Newark, N. J.
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 Nordberg Mfg. Co., Milwaukee, Wis.
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 Worthington Pump & Machy. Corp., New York.
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 Cambria Steel Co., Philadelphia, Pa.
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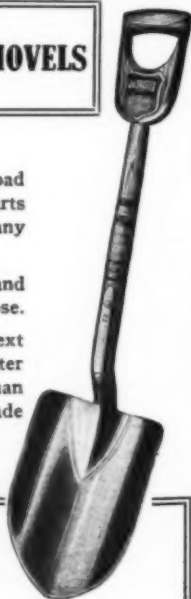
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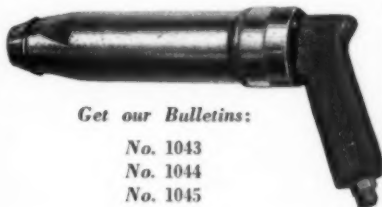
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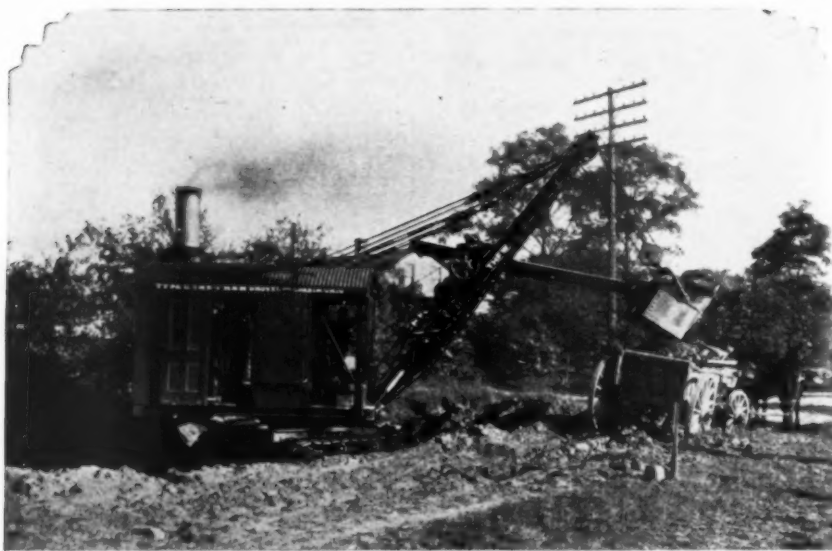
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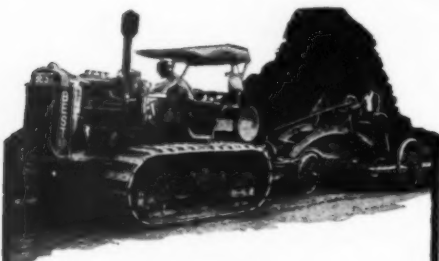
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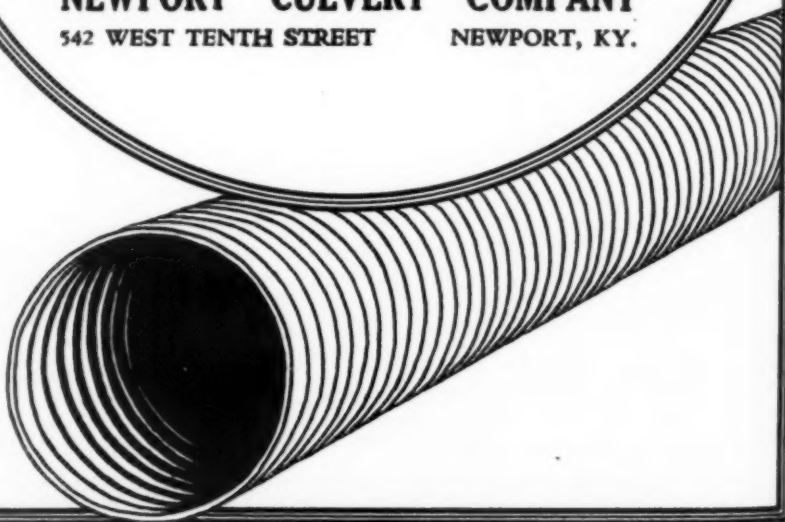
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The Use and Value of the Quantity Survey to the Building Industry

The Society of Constructors of Federal Buildings Issues Interesting Report of Its Committee on Quantity Surveys

THAT the quantity survey, as a system, has great merit is conceded by all interested in the building industry, but its general adoption in this country has been delayed by several causes, one of which, the World War, resulted in a necessary suspension of all building activities. Among other reasons assigned for the delay in its adoption may be mentioned the dubious attitude of some who imagine that a new and, as they say, non-producing factor is to be added to the industry: the query, "Who will assume the burden of cost?" is propounded. The apparent reluctance to abandon old methods, admitted to be faulty, is being dispelled, however, as knowledge of the quantity survey becomes assimilated.

The most important purpose of a quantity survey is that of rendering all bids of the competitors for the work on the same basis as to quantities. Thus, in formulating his bid, the competitor has only to append to the material costs his labor costs, "overhead," profits, etc., which may be applied by the unit system or otherwise.

These schedules are so prepared that contractors or others interested may readily determine the character and value of any article indicated. Such indications are graphic descriptions, supplemented by measurements and diagrams if necessary, but in no case are they to be used in lieu of the drawing and full-size details from which to execute the work.

A quantity survey is a comprehensive and systematically prepared schedule of all the materials to be incorporated in a structure—the result of a thorough survey and check of the required drawings and specifications by highly trained technical men.

Error Reduced to a Minimum

Some opponents have thoughtlessly condemned the system on the ground that inaccuracies may occur. An indemnifying bond as a guarantee of accuracy has been suggested. "By their fruits ye shall know them." An

architect does not guarantee the stability of a building, but he certainly suffers a loss in the event of any failure of construction.

The functional interdependence of a careful survey of quantities and a thorough check of the survey is a feature of the proposed system. The possibility of error is reduced to the minimum. What of the probability of error under the present system?

How often is the success of a competitor attributable solely to error in taking off quantities? It may be said that absolute perfection will not be attained, but it is reasonable to assume that the element of error will be no greater than that of any survey made in the office of the contractor under the usual unfavorable conditions under which most estimates are made.

In some public work the bidders are required to check the schedules, and are afforded an opportunity to make provision in their proposals for any inaccuracies which may have been disclosed, though in general practise all proposals are to be based upon the schedules as submitted to the bidders, and the low bidder will be permitted to have such adjustments as may be required after acceptance of the contract.

For obvious reasons, adjustments before the

award of contract are not generally advocated, but any antagonism due to this fact can readily be dispelled. These adjustments can certainly be made after the award of contract. The bidder is assured of a foundation, not otherwise procurable, upon which he can build a proposal.

In some instances purchases of the materials are made and bids for labor only are required. If after the surveyor's check inaccuracies still remain, and it is discovered during construction or after completion that the scheduled quantities upon which the labor bids were based were either inadequate or in excess of the requirements, then the adjustments for labor can be made.

These applications of the system are cited to show that no interests can be jeopardized by the fact that a quantity survey may lack perfection.

Accuracy Guarantee

It is now possible to obtain, with a quantity survey, a guarantee of its accuracy to within a small percentage of the total sum involved. The contractor may assume this differential by omitting it and the cost of the indemnity as components of his bid, or he may transmit them to the owner. With the view of maintaining at the minimum the cost of the quantity survey, some advocates assert that a guarantee of accuracy necessarily involves an additional cost and an element of chance for which some interest must pay, and, furthermore, is superfluous if the system is properly applied.

Because of the diverse methods of estimating employed, there really exists in connection with the present system of contract awards a competition in the quantities of materials involved by construction work. To eliminate this quantity competition is a function of the quantity survey, and thus the whole matter of competition is simplified. The intent of the drawings and specifications may be in some respects quite vague and ambiguities may exist, but to this can be attributed only a very small percentage of the wide variances of the material bills as ascertained by different estimates. The quantity survey clarifies, and every bidder commences work on his proposal with the satisfying knowledge that the entire job has been carefully examined and that ambiguities which otherwise might have been costly have been eliminated; also that every other competitor, for his guidance in making up his bid, has been supplied with the identical information with which he himself has been provided.

Cutting Out the Gamble

The necessity for improvement of methods has long been felt, and such need is emphasized by the contractor's wail that instead of engaging in a business he is playing a most hazardous game. In any discussion of a contractor's business you will hear the assertion that the business is a gamble, that profits cannot be assured, and that a contractor's hope of salvation is that from some further work an abnormal profit can be derived which will compensate or overbalance the losses sustained on work which

has been performed. This is a frank admission and is indicative of an unhealthy condition which certainly calls for the administration of some treatment. Primarily, competition will not permit a realization of the hope for large profits. The uncertainty of chance must be eliminated, or at least reduced to a minimum not in excess of that of any other business. In order to procure the necessary volume of work, it must all be on a close margin; and it is seldom, if ever, that a contractor can withstand a loss.

As diagnosed by most authorities, the fault is with the contractor himself, and consists of blindly following precedent, employing some methods which are now obsolete and others which never had any valid reason for existence; in numbers of cases there is an absolute failure to acquire the requisite knowledge of the materials to be furnished and the work to be performed.

Provide for Overhead

In addition to a profit on his material and labor costs, a contractor is entitled to a reasonable margin on his operating costs, inclusive of his own salary and the costs of estimating, with other office expenses. In every proposal should also be given due consideration to depreciation on plant and equipment, interest on borrowed capital, taxes, and losses through had accounts. If the business is to endure, such business principles cannot be ignored or laid aside for the gambling methods, and the contractor who is habitually remiss in making up his bid and who applies his prices and profits by the rule of guess cannot find salvation in the quantity survey system, as, through force of habit, he will continue his rule of guess practices and eventually be self-effaced. The contractor who excels in management is an advocate of the quantity survey system.

It has been said that the surveys could not be satisfactory, as no two estimators employ the same methods, and that the contractor, whose business it has always been, is as capable of preparing a survey as any one other person. Granting the truth of these statements, the fact remains that the one official survey, prepared by one or more surveyors, would govern any competition. There can be but one survey of any project. If it were otherwise, it is apparent that the present chaotic conditions would be but little improved.

Must Be Official

The profession of quantity surveyors and the surveys must be inseparably linked with the word "official" by virtue of license by the owner or architect. The institution of the system and its operation do not, as some suppose, provide a wide field of operation for competing surveyors, who will sell their products to the contractors. In some instances, contractors' associations have established survey bureaus from which could be procured a uniform survey of any desired project, but it is to be noted that even in this connection uniformity is the very essence of the matter.

The survey, in conjunction with the unit rates

of the proposal, has a value which will be appreciated by the owner and the architect. The uncertainty of chance being eliminated from the business of the contractor, the owner need no longer fear the possibility of being compelled to assume this chance in some degree unknown. As in any sound business arrangement, the owner, who corresponds to the consumer, must assume the costs of estimating or overhead of the vendor, the contractor.

Eliminate the Waste

Confronted as we are at the present time by the greatly increased costs of all commodities, which may or may not have reached the peak of their ascension, it has obviously become necessary to eliminate from all transactions, so far as may be possible or practicable, every source of extravagance or waste. Of the various industries, none has been more severely affected or feels more acutely the necessity for relief in some form, than building.

With the exorbitant costs of raw materials on the one hand, and of labor, skilled or otherwise, necessary to shape them into finished structures on the other, together in many instances with excessive profits or commissions being exacted by distributors and contractors, the tentative builder of limited resources, who may not hope to protect his investment by correspondingly increased rentals, is driven entirely out of the market, and the field is largely restricted to investors of unlimited means.

As it is upon the former class of investor that the industry must depend to a very large extent after the immediate demand for mercantile, public and semi-public structures shall have been satisfied, it is apparent that for the best interests of all concerned every effort should be exerted toward bringing the expenses within the limits of his means.

The System in Vogue

For relief, as concerns material and labor costs, we must apparently wait until the law of supply and demand shall ultimately lower or stabilize these, but, in the meantime, it is certain that an appreciable effect may be realized through the adoption of other more efficient business methods and procedure than now obtain, by which the added or "overhead" expenses of operation and administration would be in a measure curtailed.

For instance, by the system generally in vogue at the present time, the drawings and specifications for a proposed building project go into the offices of the various contractors from whom competitive bids are being solicited, in each of which separate estimates may be prepared in more or less detail and with varying degrees of accuracy, according as errors occur in "taking off," etc., or different interpretations or requirements are assumed; also, the limited time generally precludes even cursory checking.

The above, of course, takes no account of that class of contractors referred to above, whose estimates, being the result of a general scanning of the work contemplated and a comparison with a similar structure previously built, are only too often disastrous both to themselves and their patrons, which practise will inevitably eliminate them in time from the field.

Experience has shown that an estimate prepared with any degree of accuracy will generally range in cost between one-half of 1 per cent to 1½ per cent of the actual cost of the finished work.

Assuming that in the manner prescribed above, estimates have been prepared by six competitors, the process has been duplicated six times, which, taking the lower of the above limits, brings the total expenditure for estimating the job in question up to 3 per cent of its cost, and, under certain conditions, may reach 9 or 10 per cent, or proportionately more as the number of bidders increases.

Owner Pays for Duplicate Estimates

While at first sight it may not be apparent to the layman builder that he is paying practically the entire cost of estimating his job, both by the successful and by the unsuccessful bidders, if he will consider the fact that the operating and overhead expenses of every contracting concern include the cost of all estimates prepared both for work obtained and work lost to other bidders, and are prorated against and defrayed by the enterprises in which they are the successful bidders, he will at once realize that the estimate submitted for his particular job embraces on the above-cited basis a pro rata of the entire operating expense of the concern, which would by the law of averages very nearly approximate the above-given total cost of estimates on this job. Data compiled for this purpose have shown that the average contracting firm figures from eight to ten jobs to every one that it obtains; consequently, that one carries the estimating cost of six or more.

It will therefore be seen that elimination of this duplication in the taking of or surveying of projects must of necessity produce an appreciable saving in incidental expense. This elimination of duplication is one of the advantages to be realized from a general adoption by the building world of the quantity survey system.

Probably the chief difficulty in securing the adoption of this system is that of convincing the owner that the added fee for the quantity surveyor, which may be paid either directly or through the architect, is in reality a saving, in that under the quantity survey system he is paying for this service only once, while under the present practise (though it may not be apparent to him) it is paid proportionately to the number of bids taken.

Attaching Trim to Solid Plaster Partitions

PEDS, made by the General Fireproofing Company, Youngstown, Ohio, are claimed to be the most economical method of attaching trim to solid plaster partitions. A Ped is a small wooden disc set in a metal flange. It is bedded with the flange against the scratch coat of plaster and under the brown and white

line, it should be patted back with the finger until it clears the line. Should the disc be accidentally shoved above the line, it should immediately be removed and sufficient plaster applied to the back to bring the face of the block into alignment. After the plaster has set, drive a brad into the center of the block, stretch a line between the discs and set inter-



FIRST BUTTER THE WALLS WITH PLASTER

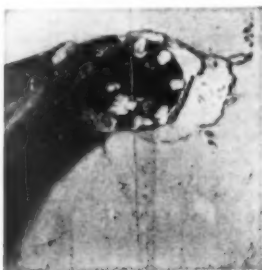
coats. When the wall is finished, therefore, only the face of the wooden disc shows, thus giving a small isolated nailing surface which can be placed wherever it is desired.

In placing these discs, enough unsanded hard wall plaster is mixed to give about the consistency of soft putty, in a small enameled



THEN BUTTER THE PED

mediate discs to the line, but do not tamper further with the one originally set. These should not be spaced more than 20 inches in centers for base, chain-rail and paneling, and not more than 30 inches for picture mold. For unusually wide trim the discs may be staggered. Finish or fixtures may be attached immediately after the finished coat of plaster is dry.



PUT THE PED IN PLACE

water-pan. Then the plaster levels at all corners of the room are determined, keeping in mind the use of thin discs on high places. The discs are set to these levels for the base, chair-rail or molding, as the case may be. The partition is dampened slightly if very dry or porous. With a small paddle a little plaster is wiped onto the partition where the Peds are to be set, using enough force to make a good bond. Then plaster is put on the back of the disc, which is pushed against the partition until the face of the wooden block frees the chalk line, the plaster oozing through the holes, forming keys. If, however, a key should extend beyond the



THE PED PLASTERED IN

Arbitration of Appraisal Fees

IN a dispute over appraisal fees charged by contractors in Newark, N. J., for work done for the city, the appraisals were sustained in court, but the city refused to pay the fees charged for that work. It did agree, however, to submit the matter to arbitration, with one arbitrator to be appointed by the contractor, one by the city, and an umpire to be selected by both.

Legal Decisions in the Contracting Field

Edited by A. L. H. Street, Attorney-at-Law

Liability of Public Corporations to Subcontractors, Materialmen, Etc.

A statute enacted in Georgia in 1916 provides that in letting contracts for public work the contractor shall be required to give bond to the contractee state, county, municipal corporation, or other public body, securing payment for labor, materials, etc., furnished to the contractor. It is also provided that if the bond be not taken, "the corporation or body for which the work is done under the contract, shall be liable to all persons furnishing labor, skill, tools, machinery, or materials to the contractor thereunder, for any loss resulting to them from such failure."

In the case of *Ty Ty Consolidated School District vs. Colquitt Lumber Co.*, 112 South-eastern Reporter, 560, the Georgia Supreme Court sustains the validity of the act.

What May be Done in "Maintaining and Repairing" Roads?

A contract for the regrading and widening of a road, the shaping up of abutting ditches, installation of culverts and proper drainage, and resurfacing the road with gravel, is authorized by a statute requiring commissioners to maintain and repair roads, holds the Arkansas Supreme Court in the case of *Higginbotham vs. Road Improvement District No. 3 of Lonoke County*, 241 Southwestern Reporter, 866. Speaking of the word "repair," the Court observes:

"A fair interpretation of the meaning of the word, as used by the lawmakers in this statute, is that it means restoration to the original state of the road after the former improvement was completed. Not exact, but substantial, restoration was intended. It was not intended that an entirely new improvement should be constructed in disregard of the original plans, but only restoration of the improvement according to the original plans, with mere incidental changes allowable.

"Applying this principle to the allegations of the complaint in the present case, we do not think that the language employed amounts to a charge of substantial departure from the original plans of the improvement. The regrading of the road may be essential for the purpose of restoration; the widening of the road does not necessarily imply a substantial change, nor does the increase in the depth of the surfacing necessarily constitute a substantial change, when considered in the light of the total cost of the improvement. This all may be done, and yet the improvement be confined substantially to repair or restoration work, using that part of the old improvement which still remains."

Sufficiency of Plans and Specifications as a Contract Basis

In the case of *Hilger vs. Chrisp*, 136 Southwestern Reporter, 660, a case passed upon by the Arkansas Supreme Court, question was raised as to whether the plans and specifications on which bids were received to construct a county bridge were sufficiently full to sustain a contract award.

The Court recognizes the rule that before bids validly can be received in such cases, "the plan of the work and the specifications according to which it is to be done must be adopted so that the only thing to be determined by the bidders shall be the price. To accomplish that purpose, the plans and specifications should not be merely of a general character, but they must be sufficiently definite in detail so that all bidders could base their bids upon the same thing that was to be undertaken."

Disposing of the case, the Court adds:

"It is urged that they are indefinite in some particulars relating to the quality of concrete that was to be used, the exact character of lumber that was to be provided, and to some parts of the superstructure. But we think, upon an examination of the plans and the specifications, this is fully covered by the terms of the specifications, which provide that the concrete should be of the best kind and the lumber of good quality, and by the plans, which, we think, make sufficiently definite the size and amount and kind of material which shall be furnished in the construction of this bridge."

Responsibility of Supervising Architect for Defects in Work

One of the most interesting cases dealing with a supervising engineer's liability for defective work constructed by a contractor is that of *Cowles vs. City of Minneapolis*, 151 Northwestern Reporter, 452.

Plaintiff was retained to supervise the construction of concrete bridges for defendant city by a contractor, compensated on a cost plus basis. After the work was completed, it was discovered that some of the supporting piles had not been driven in conformity to the contract, and the city refused to pay a balance due plaintiff, claiming that his failure to properly supervise the work deprived him of right to the compensation sued for. But the Minnesota Supreme Court affirmed judgment in plaintiff's favor on a finding that he used reasonable care in supervising the construction work, considering that he was required to pass from one of the bridges to another, that he visited the various parts of the work two or three times a day and reasonably relied on statements of the men

who drove the piles as to how deep they had been driven. In the course of its opinion, the Court says:

"Plaintiff was an engineer and was employed as such. In performing the work which he undertook, it was his duty to exercise such care, skill and diligence as men engaged in that profession ordinarily exercise under like circumstances. He was not an insurer that the contractors would perform their work properly in all respects; but it was his duty to exercise reasonable care to see that they did so. The work was progressing in different places at the same time. A large number of piles had been driven before those in question, and, apparently, had been properly driven."

Contractor's Equipment as Obstruction to Street Travel

One who drives into a contractor's concrete mixer, temporarily standing near the curb in a street in front of a building in process of erection by the contractor, is not entitled to recover damages, on its appearing that the obstruction was plainly discernible and easily avoidable. So holds the California District Court of Appeal in the case of *Jackson vs. Leonardt & Peck*, 207 Pacific Reporter, 500.

Reversing judgment in favor of plaintiff, whose automobile collided with a concrete mixer under the above stated circumstances in a Los Angeles street, the Court remarked:

"Defendant was not a trespasser upon the street, as it held a regularly issued permit from the city authorities allowing it to maintain and use the mixer at that point. Its duty, of course, nevertheless, was to so place the machine that it would not unnecessarily obstruct travel, or be likely to produce injury to those who, using reasonable care, might travel upon the street. . . . If the machine, as was the fact, was plainly discernible in all of its projecting parts to those who traveled upon the street, and was so placed that contact with it might easily be avoided, it would follow that defendant had exercised all the care required of it in the circumstances. The negligence, if any there was, which produced the damage, must be said to have been that of the driver of the automobile.

"Counsel for respondent argues that a barricade should have been built about the mixer. Such a barricade would merely have added to the obstruction presented by the machine and could not have served to give any better notice of the presence there of the mixer than did the object itself."

Authority of Public Officials to Make Contracts

There are numerous appellate court decisions that afford warning to those who contract with public officers and boards that notice must be taken of limitations on the authority of such officers and boards. An example appears in the case of *Jamison vs. City of Paducah*, 241 Southwestern Reporter, 327, where plaintiff was denied the right to recover for services as architect in preparing plans and specifications for a

municipal building, where the commissioners of the city purported to delegate to one of their number power to contract with plaintiff.

In announcing its decision, the Kentucky Court of Appeals follows its holdings in the earlier case of *Floyd County vs. Owego Bridge Company*, 137 Southwestern Reporter, 239. In the latter case, county authorities attempted to appoint a committee of three business men to contract for three bridges and to attend to the location and erection of the same. The committee caused the bridges to be constructed, but the county refused to pay for them. Holding that the bridge contractors could not recover against the county, the Court said:

"The general rule is that fiscal courts or other county boards having charge of county affairs, may, in the exercise of the powers conferred upon them, appoint agents to discharge ministerial duties not calling for the exercise of reason or discretion, but cannot go beyond this and delegate to others the discharge of duties which call for reason and discretion, as such are regarded as public trusts."

In the Paducah case the Court says:

"We have established and consistently maintained the rule that persons dealing with a municipal corporation are bound, at their peril, to know that the contracts made by the officials of such corporation are executed in the mode pointed out by its charter and ordinances, and if such persons fail to inform themselves as to whether the official has power to contract, they must suffer the consequences."

Owner's Duty to Enable Contractors to Perform Contract in Time

Where a contractor undertook to make special installation for an owner of a building in course of construction by independent general contractors, the owner was bound to keep the building in such state of forwardness as to enable the special contractor to complete his work within the time limited, according to the decision of the Connecticut Supreme Court of Errors in the case of *Stehlin-Miller-Henes Company vs. City of Bridgeport*, 117 Atlantic Reporter, 811.

The special contract in this case required the installation of plumbing, etc., "as fast as the building is in condition for it to be done, and this contractor is not to cause any delay in the progress of the work of the general contractors." The Supreme Court said:

"The rule is undoubted in circumstances such as were present in this case that an implied contract arose on the part of the defendant [owner] to keep the work on the building, whether done by itself or other contractors, in such a state of forwardness as would enable the plaintiff to complete its contracts within the time limited."

Move Philadelphia Office

THE Black & Decker Mfg. Company's branch office and service station formerly located at 318 North Broad Street, Philadelphia, has been relocated, the new address being 824 North Broad Street.

The Storage of Sacked Cement

An Important Feature for Building and Highway Contractors when Cement is Shipped in by the Car-Load and Not Used at Once

SACKED cement can be stored for several months without seriously impairing its quality, provided it is properly housed and protected against moisture. Uncertainties of transportation have shown clearly to manufacturers, dealers and users of cement the desirability of adequate provision for storage facilities, either at the supply yard or on the job. A reserve supply of any commodity in daily demand on construction work goes far toward insuring uninterrupted operation. The provision and use of adequate storage buildings eliminate the possibility of temporary suspension of construction or retarded progress when transportation conditions or other unforeseen contingencies delay the shipment of materials. To make certain of the prompt start and continuous progress of construction, there is coming into more general use the practise of accumulating in storage a supply of construction materials, including cement.

Fundamental Requirements of Storage

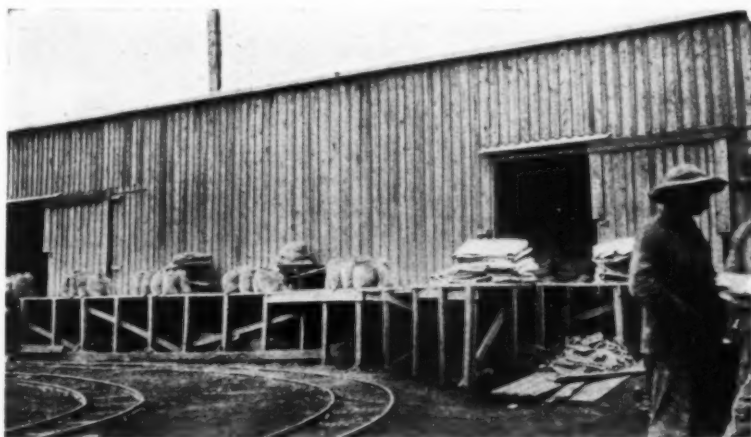
Unless properly stored, cement will soon absorb enough moisture from the atmosphere to affect its quality. It must be kept dry at all times prior to use, in a damp-proof, weather-tight building. No matter what the condition of weather or season, the atmosphere always contains some moisture. The more nearly airtight the storage building can be made and kept, so as to prevent the influence of changing outdoor atmospheric conditions, the less effect

will there be on the quality of the cement while in storage.

For storage in the immediate vicinity or on the site of construction work, so-called temporary structures are usually provided. These may be of light, simple construction, yet must be built to maintain a dry, weather-proof interior. Build the floor a sufficient distance above the ground to protect against ground moisture. A double board floor of tongued and grooved lumber is best, with the boards of the upper floor laid at right angles to those in the lower ones and a layer of card or other weather-proof paper between.

For convenience in handling the cement on the job, the floor level should be approximately one foot above the switch track or driveway approach, and the space beneath the floor filled solid with well-tamped cinders or gravel. Should it be found desirable to have the floor several feet above the track level, heavier construction for the floor will be needed to support the load.

The walls of a wooden shed may be made damp-proof by applying one or more layers of tar paper. A one-way roof is simple and satisfactory, with tongued and grooved boards well covered with tarred roofing paper to make it leak-proof. The roof should overhang the walls at least one foot on all sides of the building and should be so firmly secured to wall studs or framing that there will be no danger of its being blown off. Windows may be dispensed with, but if found necessary for light



AN ARRANGEMENT OF INDUSTRIAL RAILWAY FOR CEMENT WAREHOUSE

Where industrial railways are used in handling materials on a construction job, it is sometimes desirable to have the floor of the cement storage sheds raised several feet above the track level, to facilitate handling the cement



PERMANENT STOREHOUSE FOR SACKED CEMENT

In a permanent storage warehouse of monolithic concrete, concrete block, concrete brick or concrete structural tile construction, a supply of cement can be accumulated and stored for a considerable length of time without impairing its quality

should be placed well up under the roof overhang to make them more weather-tight.

For convenience in loading and unloading at permanent warehouses, the floor level is generally four feet above the switchtrack or driveway approach, because that is the average height of the car floor or wagon or truck body.

Piling Sacked Cement

When cement in sacks is stored in high piles

for a considerable time, there is a tendency for that in the lower sacks to cake, because of the pressure of the sacks above. Cement that has caked from this cause can be reconditioned by either rolling or dropping the sack on the floor.

Cement to be stored for a short time only may be piled twelve or fifteen sacks high, but if it is to be stored for a longer period, piles should not be more than seven sacks high in order to minimize caking or "warehouse set." The



WHERE THERE IS A DIFFERENCE IN LEVEL BETWEEN CARS AND WAREHOUSES OR TRUCKS, A GRAVITY CONVEYOR SAVES TIME AND LABOE

In the installation above, wood pallets were used upon which 4 or 5 sacks of cement were placed and slid down the conveyor

cement may be piled directly on the concrete floor, laid on a well-tamped fill of cinders or gravel or a floor elevated above the ground. The sacks should be piled closely, but not in contact with the building's side walls. No more free air space should be left than necessary, however. When cement is to be stored for a long period in permanent structures, it should be piled about one foot away from the wall.

To lessen the danger of overturning piles of sacked cement, the cement should be piled in headers and stretchers, that is, alternately lengthwise and crosswise, so as to tie the piles together. However, if piles seven sacks high are laid up carefully, there will be little danger of their overturning. This height of pile makes it easier to handle sacks in and out of the storage building, because the hand trucks used to move cement in the storehouse usually carry seven sacks.

The capacity of a storehouse depends upon its floor area and the height to which the sacks are piled. A sack of cement occupies a little over 2 cubic feet of floor space and about 1.25 cubic feet of volume space. If it is necessary to store a greater amount of cement on a given floor area, the height of pile can be increased to fourteen or fifteen sacks. This is usually the maximum which can be laid up economically.

The space of the storage building should be sufficient to allow proper clearance between the piles and building walls and three feet for trucking-aisles between piles. The different shipments should be so piled as to permit removal from storage in the same rotation as received.

Handling Sacked Cement

The most common method of handling cement is by two-wheeled hand trucks of seven sacks capacity. Four-wheeled trucks and wheelbarrows are sometimes used. Improvised platforms are sometimes used to haul sacked cement from the car to a warehouse on small jack-lift trucks and to stack it upon when stored in the warehouse. Such equipment reduces to the minimum the expense of handling in and out of storage and expedites removal when it is needed.

When cement is being moved from warehouse piles, some sacks should be removed from two or three tiers back, rather than all from one tier. If the piles are thus stepped back, particularly when they are fifteen sacks high, accidents due to the overturning of a pile of sacks are prevented. This is a Safety First warning to consider seriously.

When railroad tracks are elevated and sacks can be removed from car to storage by gravity, the unloading of cement can be simplified by using a metal-lined chute or roller conveyor. Sometimes wood pallets are made, on which four or five sacks can be placed and then slid down the conveyor. Several pallets are used, and when all have been sent down they are racked up and pushed back along the conveyor by the man doing the piling for use with further sacks.

Every contractor has problems peculiar to the conditions under which cement must be handled and stored. Methods should be selected which will be most advantageous under those conditions.

Injudicious Bidding

Don't Underbid for the Sake of the Job—Bid on Your Own Figures, Not Someone Else's

A PROLIFIC source of conversation when contractors gather together, is how much money they have lost on this or that job. Many a city or state has been enriched because of injudicious bidding of men who are after a job and who leave behind them monuments of their foolhardiness, sometimes unavoidably, but always regretfully. The fatal mistake of trying to underbid another man simply because he has bid a certain price at the preceding letting, is a danger that is ever present. Each job has its own peculiarities. The haul for the waste may be longer than in the first contract; the freight station may be twice as distant in the second contract as in the first; the congestion encountered may make it impossible to speed up the work as was done in the original job. A dozen instances of like nature may be enumerated, yet the foolish contractor in his endeavor to beat the price of a former successful competitor will not knowingly or otherwise

consider these divergencies. His is a narrow vision who says, "The other man did it for this amount, and if he can do it, I can." Why will a contractor make this common mistake and appear foolish in the eyes of the fraternity?

There is another thing to be considered. Each contractor has his own method of determining what the work is worth, but the fact remains that no job should be taken from 20 to 25 per cent less than the second low bidder, particularly when the latter is recognized as a sane bidder of long standing and conditions are equal. The sooner the contractor gathers unto himself sufficient wisdom to look after the details of his bidding sheet, the less likely will he be to donate to the city and state monuments that deplete his bank balance and take years from his life.

—Ernest T. Hanefeld, Permanent Secretary, Contractors' Association of Philadelphia, in *Construction Digest*.

Judicious Planning and Use of Well-chosen Construction Equipment in Rebuilding Municipal Filtration Plant

Ideas and Methods of Interest to Water-Works Contractors

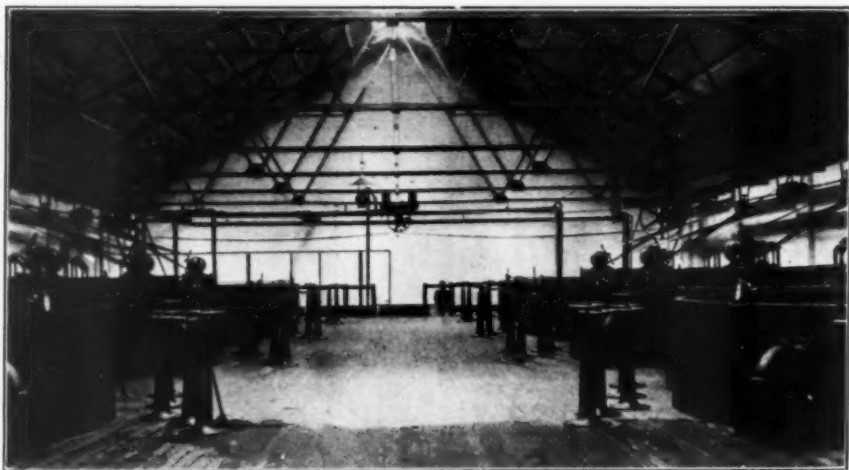
THE city of Charleston, S. C., recently had occasion to rebuild its mechanical filtration plant, substituting fourteen 1,000,000-gal-len reinforced concrete rapid sand filters for the twelve 500,000-gallon wood-tub filters which had previously been used.

The new filters are arranged in two rows of seven units each with the back walls against the side walls of the building. Between the rows and lying longitudinally are the filtered water flumes and open waste wash water drains of the old plant which were incorporated in the new works. Above the flume, which was covered over in the new work, is a pipe gallery, and then an operating floor elevated 10 inches above the top of the filters.

The filters are rectangular, with inside dimensions of 21 feet 4 inches by 18 feet 6 inches by 8 feet deep, providing a filtering area of 352 square feet. The filters are formed by reinforced concrete walls 11 inches thick. The rear and side walls turn at the top in the form of T-beams, which serve as walks. The sub-bottom is depressed in the middle, lengthwise of the filter, to form a rectangular collecting channel, and is supported not only by the side walls but by low longitudinal concrete piers, spaced midway between the side walls and the channel. Extending across the filter 14 inches from its front wall is a partition wall 6 inches thick, which forms a stilling pool for the influent and

a discharge bay for the waste wash water. The front wall is fitted with castings for connection with the influent, effluent and wash water piping in the gallery. The bottom of the influent stilling bay contains a casting to secure the waste wash water valve.

Each filter is equipped with an influent, an effluent, a wash water inlet, a wash water outlet, and a filter-to-waste valve, as well as a Simplex controller to regulate the rate of filtration and a loss of head gage. All these valves are fitted with cylinders so that they can be operated hydraulically from the marble table for each filter on the operating floor. Covering the Wheeler bottom is $11\frac{1}{2}$ inches of gravel varying from a bottom layer composed of stones which pass through a $\frac{7}{8}$ -inch hole to an upper layer composed of fine stone that passes through a $\frac{1}{8}$ -inch-diameter hole. Covering the gravel is a 28-inch bed of sand. Running the length of the filter are four cast iron troughs with semi-circular bottoms. These are connected at the front of the filter to castings in the 6-inch partition wall and are anchored to the rear wall of the filter at their far end. The troughs are supported at intermediate points by wrought-iron pipe posts. As a requisite to economical and efficient operation, the upper edges of the troughs, which are 26 inches above the top of the sand-bed, are absolutely level. This is not an easy job, but very essential.



A VIEW OF THE OLD FILTER PLANT AT CHARLESTON, S. C., BEFORE BEING REFITTED WITH CONCRETE FILTERS



THE REHABILITATED FILTER PLANT AT CHARLESTON, S. C., SHOWING NEW CONCRETE FILTERS AND FILTER CONTROL EQUIPMENT

Plant Rebuilt Without Shut-down

The new concrete filters were constructed without interference with the operation of the plant. After the wash-water engine was removed, giving sufficient space in the engine room end of the filter room to construct one concrete unit on each side of the building without disturbing the tub filters. With these new filters in service, two of the old filters on the same side of the building were removed, which made available room for two more concrete units. This general plan of successively razing the tub filters and building the concrete units in pairs was pursued until the capacity of the new filter units equaled the capacity of the tub filters. Then the remaining tub filters were razed completely and the remaining concrete units were installed at the same time. Considerable ingenuity was required at times, however, to co-ordinate the old and the new piping.

Prior to the actual construction of the first filter, there was some uncertainty as to whether the cement floor of the old filter room would sustain without undue settlement the load that the new filters would impose upon it. A test was made by selecting one of the tub filters in which surface cracks in the floor indicated its most vulnerable point. The tub was filled with sand, in order that the timber bents supporting it might transmit to the floor a load in excess of the calculated weight of the new filters. Levels taken before and after the loading showed that the floor would provide a satisfactory foundation.

Another preliminary measure was the reinforcement of the foundation carrying the 13-inch partition wall between the filter room and the engine room, where the difference in elevation of the filter room floor and the engine room basement floor is 12 feet. This was reinforced by constructing a concrete wall $2\frac{1}{2}$ feet thick

across the entire width of the building, with a foundation below that of the building wall.

The Construction Plant

Several different types of construction plant were considered. That finally decided upon consisted of an extension of the railroad siding for the receipt of all material, a 5-ton capacity stiff-leg derrick with a 60-foot boom and bull wheel, a 25-horse-power Clyde hoisting engine with a boom swing attachment, and a $\frac{1}{2}$ -yard clam-shell bucket, one 10-cubic-foot capacity Smith tilting concrete mixer and engine, elevated gravel and sand storage bins and a drying and screening plant to grade the filter gravel. Also, a house for the storage of two carloads of cement was constructed.

This plant was constructed at the far end of the pumping-station and so arranged that the derrick unloaded all the material, elevated the cement to the charging platform of the mixer, and filled the elevated storage bins, with a minimum loss of motion. As it was desired to make a continuous pour for two filter units containing 80 cubic yards, the whole plant was designed with that end in view. It was estimated that the pouring of the two units would take 10 hours; actual performance, however, required only 6 to 7 hours. The forms were made in convenient size with knocked-down panels of $\frac{3}{4}$ -inch T & G face boards, secured to frames made of 2- by 6-inch dressed lumber. The inside surfaces were cleaned and oiled before being set up. The forms were held together with $\frac{3}{4}$ -inch wrought-iron bolts, and held apart by $\frac{3}{4}$ -inch black iron pipe spacers, one end plain and the other fitted with a coupling to receive a screw plug after the forms were removed. At all right angles triangular molding was used.

As the two units were to be made monolithic, which is so essential in water-tight construc-

tion, the forms making the inside of the wall had to be supported independently of the other forms, in order that the sub-bottom and side walls might be formed simultaneously. These inside forms were hung from an upper rectangular frame of 6- by 6-inch timbers, with their corner and intermediate posts resting upon a lower frame of similar construction. The lower frame was supported clear of the sub-floor on eighteen 2-inch locked-nut washers screwed on pipes resting on the filter room floor. The pipes were encased in loose-fitting cylindrical sheaths of No. 28 gage sheet steel, and were so spaced that they came in the middle of the low longitudinal piers. After the frames and pipes were removed, the sheaths were filled with cement grout. This is probably the first time that inside forms were supported independently, the usual practise being to pour the bottom and then pour the side walls. This latter method obviously produces objectionable construction joints, which are obviated by the newer method. Havemeyer deformed square bars, varying in size from $\frac{1}{4}$ - to $\frac{3}{4}$ -inch, were used for reinforcing. It was secured and spaced by the use of spacer bars and ty-chairs. A 1:2:4 concrete mix was used. The stone and sand were measured in a sheet-metal-lined, sloping-bottom charging hopper, located just beneath the outlet chute of the elevated storage bins. The cement was then added. The necessary quantity of water to make a good mix was fed into the mixer from a barrel fitted with a quick opening and closing valve. After the batch was well mixed, it was completely discharged at one dumping into a reserve hopper with a capacity of $1\frac{1}{2}$ batches, which reduced to a minimum the interval between batches. It was delivered to the forms in wheelbarrows of $2\frac{1}{2}$ cubic feet capacity. The concrete was well-spaded in the forms with long-handled spades made on the job.

Immediately after the forms were stripped, the Wheeler bottom was placed. Metal forms were used for this work, and the mixture of 1 to 2 cement mortar was used. The Wheeler bottom contains $\frac{1}{4}$ -inch square reinforcing bars

and is secured to the sub-bottom of the filter by hairpin steel that was placed with the pouring of the filter. Upon the completion of the Wheeler bottom the balls, gravel and sand were placed.

Preparing the Sand

The gravel was obtained from the old filters and from gravel purchased locally. That obtained from the old filters was heavily coated with colloidal matter, which was removed prior to regrading by washing it in the concrete mixer until the discharged water ran clear. The sand of the old filters was salvaged. Since the extra quantity of the desired graded sand could not be obtained locally, nor purchased from a distance except at great expense, experiments were made to determine the feasibility of grading the local sand hydraulically by washing it in a small wooden tank equipped with a miniature Wheeler bottom. The results obtained in the test were most satisfactory, showing that the local sand could be made acceptable by washing and then skimming off the finer grains brought to the surface by a high velocity wash. Thus, when the sand was placed in the new concrete units, an excess quantity was put in to allow for skimming. The skimmings, however, were not a loss, but were used afterwards in the mortar of the concrete for the engine room floor.

The construction of the filters necessitated the making of many changes in the filter building, particularly the complete closing of two large doorways and the partial closing in of seven large windows on each side of the building. This was accomplished at relatively small cost by utilizing the brick salvaged from the foundation of the George Street stand-pipe and giving the veneer panel walls thus formed a stucco finish. Sills for the unremoved part of the windows were obtained by cutting down to the proper size the granite stone steps of the former doorways.

ACKNOWLEDGMENT.—Prepared from a paper presented before the Twelfth Annual Convention of the Tri-State Water and Light Association.

Contractor Operates Stone Quarry in Winter

L. L. BEYE, Omaha, Neb., highway contractors, find it impossible to carry on ordinary construction operations during the winter and usually are content with carrying over a nucleus organization, frequently having nothing whatever for them to do, but paying them merely to hold them. Last winter, however, they found an opportunity to keep quite an organization going, including labor. They had a contract in Allen County, Kans. (still uncompleted), and for this contract during the winter months they operated a stone quarry and got out all the crushed rock requirements.

From a financial point of view this was a practical thing to do, because the contract provided estimates on material, and the burden of getting out the rock during the winter was not

too great, as they were paid 90 per cent by the county on the estimated cost of all rock produced during the winter months.

Such an operation would not be practicable from a financial point of view in the state of Nebraska on municipal work, because estimates are not allowed on materials delivered at the jobs. Otherwise, for specifications calling for crushed rock, contractors might occupy themselves during the winter by getting out their rock requirements or could purchase their rock requirements for delivery during the winter so as to keep a quarry operating. Where sand and gravel are used, it would be difficult to have deliveries made during the winter, because of the use of water in the cleaning and grading operations.

—The Constructor.

Breaking Rock in Shallow Banks

By J. H. East

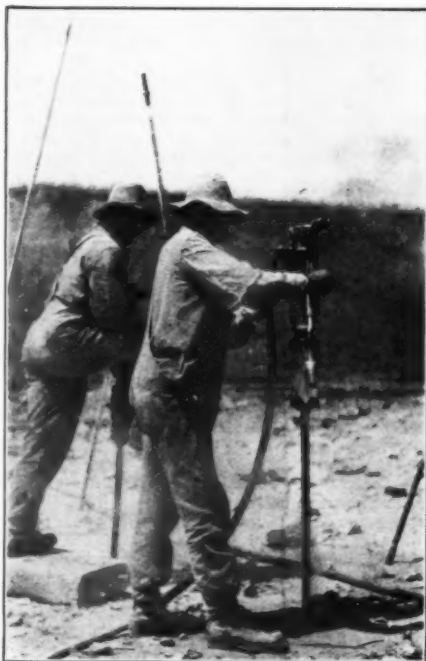
Mining Engineer

A PROBLEM of vital interest to every one concerned with the excavation of broken rock or ore in shallow cuts and banks, is the proper preparation or breaking of the rock after the primary blasting of drill holes. The large rocks remaining in the pile of broken material after the primary blast, must be broken before they can be loaded by steam shovels or by hand labor. This secondary blasting, whether by block-holing or by bulldozing, adds materially to the cost of the rock product because of the increased dynamite consumption and the loss of production caused by delays from blasting. Too little attention has been paid in the past to the proper spacing of the drill holes, the method of loading, and the grade of dynamite used for blasting, with the result that in many places the delays due to secondary blasting alone amount to fully 40 per cent of the total working time.

The use of air hammer drills for primary development work in shallow banks up to 40 feet high, has given a more uniform rock product with fewer large boulders, and a consequent reduction in the secondary blasting. Spacing the smaller-diameter air drill holes closer than in the usual churn drill practise gives a more even distribution of the explosives in the block of ground to be blasted. The same quantity of dynamite is used in both cases, though experiments are being made to determine if a larger tonnage per pound of dynamite used can be obtained.

The usual churn drill practise in shallow banks is to drill 5½-inch holes, spaced 10 feet apart and 12 to 14 feet from the face of the cut. The holes are drilled from 3 to 6 feet deeper than the floor of the cut, to insure against "hard bottom." The dynamite is loaded into the holes without previous springing, and in a 5½-inch hole approximately 13 pounds of dynamite can be loaded per running foot of hole. Eighteen to twenty feet of stemming is required to confine the charge, which represents 50 per cent or more of the total footage drilled. The cost of churn drilling is of course variable, but in soft rock, such as limestone and cement stone, 40 to 70 cents per foot can be safely assumed. Normally, a churn drill under these conditions will drill from 40 to 60 feet per 10-hour shift.

Modern practise in using air hammer drills for primary development is as variable as in the case of churn drills. The holes are usually spaced 4 feet apart and 5 feet from the face, with the different rows of holes staggered. The bottom diameter of the holes is usually 2 inches, which permits loading approximately 1.7 pounds of dynamite per running foot of hole. The holes are drilled from 1 to 3 feet below bench grade to insure against hard bottom. Generally the holes are loaded with dynamite, without previous springing, to within 5 or 6 feet of the



STARTING A HOLE

collar of the hole; this space must be left for stemming. Only 10 to 15 per cent of the hole is thus required for stemming, against 50 per cent and more for 5½-inch churn drill holes.

The air hammer drills are operated from tripods and from handles, and in a few cases when very deep holes are being drilled, a special mounting is used. The drills capable of doing this class of work must have a very powerful rotation to handle the long drill steel and must be equipped with convenient and effective means of cleaning the holes, which are generally drilled dry; the cuttings are blown from the holes with compressed air. The Turbo drill, Model 21, and the Dreadnaught drill, Model 65, both manufactured by the Denver Rock Drill Manufacturing Company, of Denver, Colo., were observed drilling deep vertical holes in some of the eastern limestone and cement stone quarries. In one limestone quarry, the Turbo drill on a special mounting was drilling holes 36 feet deep and 2 inches in diameter at the bottom, and at another quarry having a bank 20 to 25 feet high Turbo drills operated from tripods were drilling holes 25 feet deep, having

a bottom diameter of 2 inches. A Dreadnaught, Model 65, mounted on handles, was drilling holes 18 feet deep, spaced 5 by 5 feet, and supplied broken rock for a small revolving shovel engaged in making a railroad cut. The drilling rate in limestone or cement stone for both the Turbro drill and the Dreadnaught drill in the quarries observed, averaged from 200 to 250 feet per shift of 10 hours.

The cost of drilling varies in the different quarries, but in several the cost was stated to be less than 12 cents per foot. The low cost of drilling and the high drilling speed when compared with churn drilling make it possible to drill a much larger footage with the air hammer drills for the same cost per ton broken; in other words, a better distribution of ex-

plosives in the block of ground to be broken is obtained without additional cost, and the reduction in the secondary blasting expense is saved.

The present air hammer drills cannot compete with the churn drill in high-bank mining, where the spacing of the holes may be increased to break 35 to 40 tons per running foot of hole, but in low-bank mining and in shallow cuts the air hammer drill can be used to advantage. The mining men and contractors are replacing with air hammer drills the churn drills formerly used, since the development of the new drill has made possible the drilling of deep vertical holes. A more extended use of these drills in this class of work can be expected.

Four Months of Unparalleled Building

FIGURES for contracts let during last July are astonishing. Data published by the F. W. Dodge Company for the twenty-seven northeastern states show that July was the fourth consecutive month to surpass all previous records. Although it fell a little behind the unprecedented figures of April and May, it surpassed those of June, and the record of each of these four months is unequalled by that of any earlier month whatever.

The height of the columns in the diagram corresponds to the value of contracts let in each month since the beginning of 1920. The sloping curves show a cumulative total from the beginning of this year, on a scale ten times that of the columns. The heights of the white arrows show the total value of contracts from the beginning of this year to the first of August.

The magnitude of the July figures indicates that the present building boom is of even larger proportion than has been realized. Although industry generally is experiencing a decided revival from the recent depression, there is no other industry that is exceeding all previous records in the way that construction is doing. Probably automobile manufacturing comes the nearest to it.

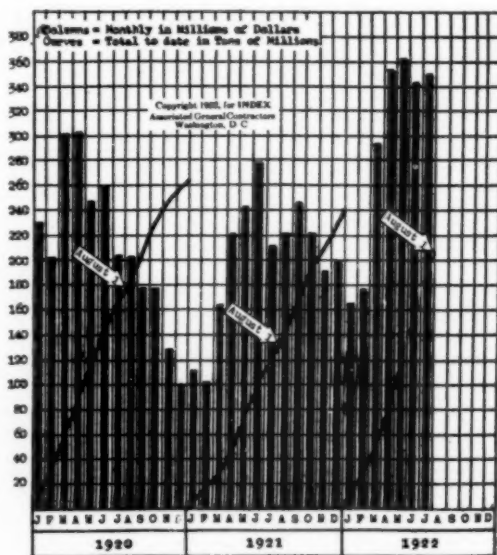
There are indications that the building boom as measured by monthly volume of contract awards has passed its maximum in the northeastern part of the country and is proceeding westward. The figures for New England show a decrease of 32 per cent from the preceding month, those for New York State and Southern New Jersey a decrease of 4 per cent, and for the Middle States 2 per cent; on the other hand, the contracts let in the Pittsburgh district show an increase of 10 per cent over June, and those for the Central West, comprising Illinois, Indiana, Iowa, Wisconsin, Michigan, and Missouri, show an increase of 19 per cent.

The July figures also show some change in the character of construction. There was a decline in the volume of residence construction, which was more than equalized by the increases in industrial and public works construction. Residential construction, however, still maintains the lead, amounting to nearly \$109,000,000 in July, or 31 per cent of the month's total.

Reprinted by courtesy of Index.

Power-Plant Improvements

WE are informed by J. W. Vogel, City Clerk, Ridge Hill, Mo., that Arthur L. Mullergren, consulting engineer, Kansas City, Mo., has been retained by this city to prepare plans and specifications for power-plant improvements.



VOLUME OF CONTRACTS SINCE 1920

Illustration of Cost Plus Contract Operation

By H. D. Grant

Staff of W. B. Richards & Co., Accountants and Engineers

THE author knows of a contracting company which operates under this form of contract only and finances every contract taken. The company advances the fund to be used to liquidate approved vouchers, and each advance is deposited in a separate bank account, which is known by the number given to the contract. Each account so incorporated is drawn on by checks of a numbered series bearing the same number as the contract, thus distinguishing the cash records of receipts and disbursements for a specific contract. The fund, plus reimbursements from the owner, when reduced by the withdrawals for payment of approved vouchers and the amount of percentage due the contractor, leaves a balance which is the amount of the fund. The advantages of this system lie in the fact that it prevents any confusion of receipts or disbursements pertaining to the contract by the translocation of charges and credits. The check paid the contractor for the percentage, as drawn from these direct funds, is entered on the Cash Record of his general books as a debit, and credited to Owner in the Customer Ledger. When such a payment is deposited in the bank controlling the general funds of the contractor, a journal entry is made as follows:

Debit: Accounts Receivable "Owner"
Credit: Profit on Contract

This record may be considered as the entry of the net sale or income from the contract.

In cost plus contracts the owner shoulders the burden of all contingencies and the contractor's only worry is to avoid any irregularity of performance that would justify any claim against him resulting in a curtailment of the profits anticipated under the original agreement. Considerable advantages often accrue to the benefit of the contractor in a contract of this class, especially when prices are rising. For example, suppose a contract is awarded on a cost plus 5 per cent basis, and the official estimate of the cost to complete is \$1,000,000, with a time limit of two years. Assume that such conditions as those of the World War arise soon after starting time and that costs up to that time for labor, material and overhead have been in conformity with the estimate;

likewise, progress as shown by the report of the cost engineer by units and percentage has been in strict accordance with the expectations under the contract. If, at this point, vendors commence to bill lumber at \$45 per 1,000 feet which was estimated to cost \$15 per 1,000 feet, if bricks are billed at \$22 which were to cost \$9 per 1,000, if labor jumps to 50 per cent above that estimated, etc., what is the result? The estimate has to be revised to correspond with the increased costs.

If the work is so important that it cannot be abandoned and it is decided to finish at any cost, for the purpose of demonstration let us assume an increase in cost of 100 per cent and that the percentage to the contractor is 5 per cent. Therefore, instead of getting 5 per cent

on \$1,000,000, the original estimate, he gets it on \$2,000,000, which increases his profits to \$100,000 instead of \$50,000. The contractor does no more work, yet he is paid twice the compensation which the owner thought to be ample under the original agreement. As it seems to the author, the contractor is paid a bonus of 100 per cent for the penalty inflicted on the owner occasioned by increased prices over those submitted—a contingency unforeseen at the time of allotting the contract.

To protect the owner against paying unfair compensation in excess of that to which the contractor is entitled, a proportion of the percentage should be reserved by the owner until a final payment is made. This can be done by the owner's paying, say, three-fifths and reserving two-fifths of the rate during the process of construction. The amount of cost on which the contractor could collect full rates might be arranged at 5 per cent above the cost estimated. This arrangement would be an upset limit to the profit of the contractor, and to make the contract attractive the owner could agree to pay, say, 25 per cent of the amount saved under the cost estimated. The incentive to the contractor under such a contract can be illustrated by the following figures:

The contract is allotted at an estimate cost of \$2,000,000	
The cost at finish is.....	1,000,000
The saving to the estimate is.....	\$ 100,000

COST PLUS CONTRACTS

This class of contract was frequently employed between the United States Government and contractors during the war, and is increasingly being used to-day under certain safeguards and limitations. The contract is given and taken on the basis of a certain percentage which the owner must pay to the contractor on the actual cost of the construction involved. The cost is measured by a statement of expenditures, with vouchers attached to show the contractor's disbursements. The total disbursements, plus the percentage as agreed, is the amount of reimbursement to be paid by the owner, and such percentage is the contractor's profit for the performance of the work.

The percentage to the contractor is	
$1,900,000 \times .05 =$	95,000
The bonus for saving is $100,000 \times .25 =$	25,000
Total profit paid to contractor.....	\$ 120,000

The contract is allotted at an estimated cost of \$2,000,000, but results in a cost of \$2,200,000. As the upset limit of cost, which is subject to the 5 per cent profit, is \$2,000,000 $\times 1.05 =$ \$2,100,000, the profit paid to the contractor is \$2,100,000 $\times .05 =$ \$105,000. Thus, when we compare the two results there would be a gain to the contractor of \$120,000 — \$105,000 = \$15,000, if there is a saving to the owner under the estimate instead of an increase of cost over the limit agreed, equal in both instances to \$100,000.

When a contract is let under the above condition, the saving to the owner should be the paramount object with the contractor, as the most he can collect is 5 per cent on the 5 per cent excess cost, as estimated, in addition to 5 per cent on the estimated cost; whereas, under the offer of a bonus of 25 per cent of any saving on the estimated cost, he gets an increased profit in the proportion that 5 is to 25, or equal to five times the percentage agreed upon. If the saving is \$200,000, the contractor gets \$200,000 $\times .25 =$ \$50,000, or a bonus of 25 per cent.

Anticipated earning at 5 per cent	
$\$2,000,000 \times .05 =$	\$100,000
Actual earning at 5 per cent	
$\$1,800,000 \times .05 =$	\$90,000
Realized percentage and bonus	90,000 Percentage on cost
Unrealized percentage....	\$140,000 Total profit
	\$ 10,000 Loss

The above figures show that he loses 5 per cent and gains 25 per cent on \$200,000, or

\$50,000 — \$10,000 = \$40,000 more than was expected. This answers the question, what is the incentive to save in the cost to the owner by performing at a cost under the estimate?

Such a contract is similar to that of a fixed fee contract in so far as it is a protection against excess costs to the owner.

In the operation of cost plus contracts, the fund method previously referred to will be admitted to be the only practicable plan when it is realized that the cost accounting is all done in the field, from duplicate records, of which the original goes to the owner, in order that he may reimburse the contractor; the duplicate remains with the contractor and constitutes his field record. The fact should be noted that the fund would have to be higher at the peak of the work than in its early or later days; but it is easy to forecast expenditures for short periods, so that the fund may provide at least for current weekly reimbursements. The only account necessary on the books of the general contractor would be one with the disbursing agent for the original amount, plus any increase and minus any decrease of the fund and the credit to Accounts Receivable for the percentage collected. All field stationery should be adapted for use only with each contract, that is, all purchase orders, invoices from vendors, store-room orders, pay-roll, vouchers, checks on bank, etc., should contain a complete series of numbers from one up to a final number, beginning and terminating with the start and the completion of the work.

EDITORIAL NOTE.—Prepared from "Practical Accounting for General Contractors," by H. D. Grant, of the staff of W. B. Richards & Co., Accountants and Engineers, New York City. Published by the McGraw-Hill Book Company, Inc., New York City. This book is a complete text-book on accounting for contractors and should be in the library of every contractor as a reference volume.

Well-known Manufacturers Consolidate

THE Patten Manufacturing Company and the Street Brothers Machine Works, Inc., Chattanooga, Tenn., have announced that on November 1 they effected a consolidation. These two companies have been prominently identified with the construction machinery industry for the past 15 or 20 years. The products of the two will henceforth be manufactured and marketed by Street Brothers Machine Works, Inc. Street's extensive line of large hoisting equipment, together with the complete

line of small and medium-size Patten hoists, will form a comprehensive and up-to-date line of modern hoisting equipment consisting of all sizes of electric, gasoline, steam and belt hoists, mine hoists, cargo hoists, capstans, winches, wood and steel derricks, derrick fittings, cableways, log loaders, and log skidders, both ground and aerial. J. H. Street will continue as President of the consolidated companies and J. W. Burruss of the Patten Manufacturing Company will become Sales Manager of the new company.

Who Makes Rock Crushers and Pulverizers?

Frequently you are confronted with the question of who makes a specific kind of equipment. By consulting the "Where to Purchase" directory beginning on page 3 of the CONTRACTORS' AND ENGINEERS' MONTHLY your query is quickly answered.

ASSOCIATED GENERAL CONTRACTORS

NEWS NOTES AND COMMENTS

Practise of Day Labor on Public Work

By Eugene Young

Executive Secretary, Associated General Contractors of America

TO meet the problem arising out of the practise current in some states of handling public work by day labor, the Executive Board of the Associated General Contractors of America has approved the framing of legislation similar to that in force in Minnesota, requiring accurate and complete accounts of all public work or construction, which shall be open and available to the public, and has also approved a campaign to secure the enactment of this legislation in every state.

A discussion of the problem by members of the Board brought out the fact that the Southern California Chapter had been successful in having a bill on this subject passed by the State Legislature, but that it had been pocket-vetted by the Governor—action which helped defeat him in the following primaries. During the campaign to pass this measure, it was shown that of 300 jobs done by day work in California, on only five could the cost be determined, and on only two had bids been received from general contractors. On one of these the cost to the state had exceeded the low bid by 60 per cent, and on the other by 80 per cent. The bill as introduced in California provided that the estimated cost of the work should be published, that bids should be received, and if the work was finally executed by a public body, the final cost should be published.

Before the passage of the law in Minnesota, it was feared that the provision requiring bids would defeat the measure, and this was therefore omitted. The other two provisions, however, were considered essential.

It was suggested at the meeting that further provision should be made for the publication of any changes in the plans or specifications during construction in connection with the publication of final costs; that a time limit should be set on the publication of final costs; and that such statement should be audited by a certified public accountant.

In Illinois it was reported that the law limiting work done by day labor to \$500 was evaded by politicians by splitting up the work into units the cost of which was less than \$500.

In Michigan, the law requiring the award of contracts to the lowest responsible bidder does not prevent public work by day labor.

In Utah, Federal Aid work is being carried on by day labor, and municipal work is being

split up into smaller units, as is the practise in Illinois.

It was suggested that a thorough analysis should be made of the reasons for doing work by day labor, including political machines, labor propaganda, jealousy of engineers, incompetency of contractors.

Following is the report of the Special Committee appointed by the Associated General Contractors' Executive Board to consider a plan of procedure relative to the construction of public works by day labor:

"Your committee appointed to report upon a plan of procedure relative to combating the construction of public work by day labor recommends:

"That the bill passed by the Minnesota Legislature, with changes hereafter noted, be used as a basis for drafting a model bill for distribution to contractors in the different states. The changes suggested are in substance as follows:

"(a) The estimated cost of each project shall be published at least fifteen days before awarding the contract or before the beginning of construction work in event that no contract is awarded.

"(b) The accounting of the cost of the work shall be made to include all items connected therewith, in event that the Minnesota bill, after further consideration, is found to be not all-inclusive. These items shall fully cover the expense of equipment, depreciation, repairs, accounting, time of employees drawn from other departments, engineering and architectural service, and all other items connected with the work.

"(c) The accounting shall be completed and both the estimated and the actual cost published within ninety days after substantial completion of the work.

"Your committee further recommends that the model bill for distribution to local associations and individuals be accompanied with a statement of the principles involved in the question of day labor construction, leaving for persons in any locality such modifications of the bill as may be necessitated by state laws, or other consideration.

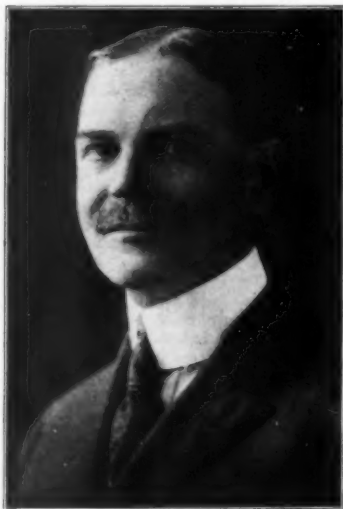
"It is further recommended that the General Manager be requested to take such steps as appear advisable to further the intent of this

bill with respect to construction work performed by the Federal Government.

(Signed) J. H. ELLISON
H. W. BAUM
C. F. MINNICK
STANLEY D. MOORE
A. P. GREENSFELDER
Special Committee

A. G. C. Biographies

Leonard C. Wason, President, Aberthaw Construction Company, Boston, is a firm believer in the Aberthaw Lexicon in which there is no such word as "I." They speak of the company and not its individuals. From its beginning the company has sought success through team work. Its name was taken from a town in Wales, from which came the limestone first manufactured into portland cement.



LEONARD C. WASON

The Aberthaw Construction Company, which has lately turned its first quarter-century milestone, is the outgrowth of an association of four graduates of the Massachusetts Institute of Technology. In 1894, having decided that concrete was the building material of the future, they set themselves to persuade New England of the fact.

For want of loftier opportunity, Aberthaw began its career by building sidewalks. Once down, a sidewalk is, so to speak, *down*; and to that extent may be trusted. And concrete walks were, of course, inexpensive as compared with those of flagging. An item of com-

pany policy has always been to honor the small job. It had to be policy then; for all the jobs were small. Another item was, and still is, to do any piece of work perfectly, if at all.

The fact that Aberthaw sidewalks stayed put helped to establish confidence. Later on, two monumental accomplishments in concrete construction at one and the same time fixed the reputation of the company and established concrete in New England beyond peradventure as a building material. First of these was the Harvard Stadium, erected in 1903, pioneer among the great academic athletic arenas of the United States. The following year witnessed a less spectacular but considerably more difficult feat of construction in the building of a concrete standpipe at Attleboro, then the largest standpipe in the world.

But the policies which governed in sidewalk-laying days still govern. First, there is the policy—or habit—of cooperation. The Aberthaw staff is very much a happy family, just as when its president, Mr. Wason, was a carpenter and the general manager handled a pick. Mr. Wason is Vice-President of the Associated General Contractors of America, and is a very close and active student of all the economic problems affecting construction.

J. T. Calhoun, J. T. Calhoun & Company, Nashville, Tenn., entered the construction game as a water boy when fourteen years of age, and worked his way up to General Superintendent. About twenty years later he bought an interest in a contracting firm in Nashville, where he specializes in railroad and highway construction. His work has included over a million dollars' worth of construction for the railroads of Alabama and Tennessee, where he has won the reputation with his men for staying on a job till it is finished.



J. T. CALHOUN

MATERIALS-MACHINERY

MOTOR TRUCKS, ETC.

The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

A BIDDING BOOK FOR CONTRACTORS

The Asphalt Sales Dept. of the Texas Co., 17 Battery Pl., New York City, has issued the "Texaco Bid Book" for contractors to use in abstracting bids at various lettings. A copy will be sent free on request.

STEEL VERSUS WOOD CURB FORMS

The Heltzel Steel Form and Iron Co., Warren, Ohio, has just issued a new folder, describing the advantages of steel forms for concrete curb construction over wooden forms.

CONCRETE MIXERS FOR SPEEDY WORK

The reason why Smith mixers are being used on big construction jobs as well as little ones to-day is described in detail in the latest literature of the T. L. Smith Co., 1021 32nd St., Milwaukee, Wis.

A NEW ASPHALT PAVING BOOKLET

The Standard Oil Co. of Indiana, 910 S. Michigan Ave., Chicago, Ill., will be pleased to send to contractors and engineers a copy of its new booklet recently issued, telling of the latest method of constructing and maintaining bituminous pavements.

WOOD BLOCK FLOORS FOR FACTORIES

The Jennison-Wright Co., Toledo, Ohio, will be glad to send a copy of its booklet describing redwood block floors, to any interested contractor having work of this type in prospect.

REINFORCED CONCRETE PILES

The literature of the Raymond Concrete Pile Co., 140 Cedar St., New York City, describes in detail the method of building up this type of pile and its advantages in various types of foundation works.

AIR DRILLS SPEED UP WORK

The Chicago Pneumatic Tool Co., 6 E. 44th St., New York City, has just issued a new bulletin describing in detail its Little Giant air drill, which can produce over four holes per minute through heat-treated metal.

STEAM SHOVEL INFORMATION

In the latest bulletin issued by the Erie Steam Shovel Co., Erie, Pa., there is a great deal of information on the new continuous-tread mechanism which enables the Erie shovel to operate to particular advantage.

LOCOMOTIVE CRANES SPEED CONSTRUCTION

The literature of the Brown Hoisting Machinery Co., Cleveland, Ohio, gives particularly valuable data on the use of locomotive cranes in speeding up structural steel building construction.

A COMPACT ELECTRIC ENGINE FOR DERRICKS

A new 15-horse-power, 4,000-pound-capacity hoisting engine operating at 60 feet per minute, recently put out by the J. S. Mundy Hoisting Engine Co., Newark, N. J., is described in detail in literature which will be sent free upon request.

DESIGNING DATA FOR REINFORCED CONCRETE

The North Western Expanded Metal Co., 407 S. Dearborn St., Chicago, Ill., has issued a valuable 94-page book, "Designing Data for Reinforced Concrete," covering the use of expanded metal for various types of reinforced concrete structures. This book can be secured free by any interested contractors or engineers.

ALL-STEEL CONCRETE MIXERS

The American Cement Machine Co., Inc., Keokuk, Iowa, will be pleased to send to contractors details regarding its new 1923 prices and terms, as well as structural data regarding its all-steel concrete mixers and hoists.

REINFORCING STEEL FOR IMMEDIATE USE

Contractors making quick connections on bids and jobs should secure the literature of Joseph T. Ryerson & Son, Chicago, Ill., regarding Ryerson steel reinforcing service.

SAVING THE CEMENT IN EMPT Y BAGS

The Willsea Works, Rochester, N. Y., will be pleased to send information and prices covering its machine for removing all of the cement from supposedly empty cement bags.

ASPHALT PAVEMENT COSTS

The Barber Asphalt Co., Land Title Bldg., Philadelphia, Pa., has issued a booklet, "The Last Analysis," which it will be glad to send to contractors and engineers interested in the first and last costs of asphalt pavements under all service and temperature conditions.

IMPROVED GALVANIZED IRON PAILS

The literature of the Rochester Can Co., 109 Hague St., Rochester, N. Y., describes in detail the recent improvement it has made by placing additional reinforcement on galvanized iron pails for contractors' use.

FOUR-CYLINDER GASOLINE ROAD ROLLERS

A four-cylinder gasoline road roller, equipped to handle road machinery, and having all the functions of a steam machine, is described in detail in literature which may be secured from the Acme Road Machinery Co., Frankfort, N. Y.

ROAD TRACTOR OPERATING WITH KEROSENE

The numerous features regarding the Little Giant tractor, made by the Little Giant Co., 231 Rock St., Mankato, Minn., are described in detail in literature which may be secured free on request by interested contractors and municipal engineers.

A NEW 3/4-YARD UNIVERSAL SHOVEL

A 3/4-yard universal shovel with tractor tread and other new features which make it a distinctly serviceable all-round shovel, is described in detail in the latest literature of the Bucyrus Co., South Milwaukee, Wis.

MOTOR TRUCKS WITH POWER

The literature of the General Motors Truck Co., Pontiac, Mich., gives details regarding the GMC truck which has undergone the unique test of running up a ramp and standing on its back wheels until the rear end of the chassis dragged on the ground.

PROTECTIVE EDGES FOR CONCRETE CURBS

The literature of the W. S. Godwin Co., Baltimore, Md., describes in detail Godwin steel curb guards, which furnish a protective edge for concrete curbs, platforms, and steps.

CONCRETE ROAD REINFORCEMENT

The Truscon Steel Co., Youngstown, Ohio, will be pleased to send to any interested contractors or highway officials complete information and standard specifications for the use of flat sheets of reinforcing material for concrete roads.

THE LUBRICATION OF POWER SHOVELS

The Thew Shovel Co., Lorain, Ohio, has recently issued a very interesting bulletin on shovel lubrication, which should be in the hands of every contractor operating power shovels of any kind.

A TRACTOR TO REPLACE TEAMS

How Cletracs have replaced horses in many grading jobs is told in an interesting manner in the literature of the Cleveland Tractor Co., 19211 Euclid Ave., Cleveland, Ohio.

FORM CLAMPS FOR CONCRETE WORK

The latest literature of the Victor L. Phillips Co., 7th and Delaware Sts., Kansas City, Mo., describes in detail the Phillips form clamp, which is quickly adjustable and entirely free from slipping.

AMERICAN ROAD BUILDING ILLUSTRATED

Contractors will be interested in the rotogravure magazine entitled, "American Road Building," issued by the Russell Grader Mfg. Co., 2207 University Ave., Minneapolis, Minn. This magazine contains pictures of all kinds of road construction work, as well as completed roads.

WATERPROOFING WALLS AND FLOORS

A complete description of GF No. 10 paste for thoroughly waterproofing basement walls and floors will be found in the free literature of the General Fireproofing Co., Youngstown, Ohio.

EQUIPMENT FOR SAND AND GRAVEL PLANTS

In Bulletin No. 11, issued by the Greenville Mfg. Co., Greenville, Ohio, contractors and others contemplating the construction or improvement of sand and gravel plants will find much information of interest and value.

SINGLE-STAGE CENTRIFUGAL PUMPS

Contractors and purchasing agents having pumping problems should secure a copy of Bulletin 249, issued by the Dayton-Dowd Co., 346 York St., Quincy, Ill., describing its complete line of Type CS single-stage, double-suction centrifugal pumps.

DATA FOR HAULING CONTRACTORS

Any man in the hauling business or having problems in material handling will be interested in the new 32-page booklet recently published by the Detroit Trailer Co., Inc., 954 E. Milwaukee Ave., Detroit, Mich., describing the uses of Detroit trailers with tractors for handling a great variety of hauling problems.

POWERFUL WIRE ROPE

In Price List K, the Broderick and Bascom Rope Co., 801-809 N. First St., St. Louis, Mo., gives interesting and valuable information regarding the use, service and price of all types of wire rope for all contracting uses.

WHY BLACK SHOVELS ARE BETTER

Any contractor having doubts as to the value of black shovels as made by the Pittsburgh Shovel Co., Oliver Bldg., Pittsburgh, Pa., should secure a copy of the latest catalog of this company, describing its shovels, which are made in all grades and sizes for every purpose a contractor can imagine.

ALL KINDS OF WAGONS

Geo. H. Holzbog & Bro., Jeffersonville, Ind., have recently issued a new catalog describing their line of wagons for handling all kinds of rubbish, and listing other types of wagons which they will build to order for any special service.

SAND AND GRAVEL DRYERS

Littleford Bros., 500 E. Pearl St., Cincinnati, Ohio, have just brought out a new sand and gravel dryer, No. 13, which does away with the need of mechanical equipment for this type of work. This dryer is described in detail in literature which may be secured free on request.

EXPANSION JOINTS THAT LAST

Samples of Elastite joints which never need repouring and which are used for concrete, brick and block pavements, sidewalks, flumes, aqueducts, bridges, viaducts, reservoirs, stadia and large buildings, are described in detail in literature which may be secured from the Philip Carey Co., 9 Wayne Ave., Lockland, Cincinnati, Ohio.

PNEUMATIC BUSHING TOOLS

Pneumatically operated tools for surfacing and drilling all concrete surfaces, as well as a complete line of hand tools that are used in daily work by contractors, are described in detail in Bulletin 1043-1045, issued by the Thomas H. Dallett Co., Broad and Federal Sts., Philadelphia, Pa.

TRACTORS WITH VERSATILITY

An illustrated booklet, "Caterpillar Performance," issued by the Holt Mfg. Co., Inc., Peoria, Ill., describes in an interesting manner the great variety of jobs which are handled by Holt caterpillar tractors in various sizes.

TANDEM MOTOR ROLLERS FOR ASPHALT

The Tandem type of power-propelled roller for use in rolling asphalt pavements, turf, walks, golf, polo and aviation grounds is described in detail in the literature of the Buffalo-Springfield Roller Co., Springfield, Ohio.

SELF-SINKING CONCRETE PILES

Full information, including illustrated literature may be secured from Woods Bros. Construction Co., Lincoln, Neb., describing the Bignell concrete pile, which sinks itself in sandy soil and which is used extensively for retard work and for foundations for bridge piers.

ZINC IN BUILDING CONSTRUCTION

The literature of the New Jersey Zinc Co., 160 Front St., New York City, describes in detail the use of Horsehead zinc for gutters, spouts, roofing and other metal work fittings, and gives a statement of its life as compared with other building metals.

LONG-LIVED DINKEYS

In the literature of the H. K. Porter Co., Pittsburgh, Pa., contractors will find much interesting information regarding the reason for the superiority of Porter locomotives for the past 55 years.

MOTOR TRUCK TURNABLES

In the recent literature issued by the Blaw-Knox Co., Pittsburgh, Pa., contractors will find some interesting information regarding the new Blaw-Knox turntable, which has done much to expedite material-handling on many road jobs this last season.

THREE-WHEEL TRACTORS

The new H.P.-40 tractor, with crawler tread and single forward wheel, which operates well on soft wet roads, is described in detail in literature which may be secured from the Hadfield-Penfield Steel Co., Bucyrus, Ohio.

SERVICEABLE TYPES OF DUMP BODIES

The National Steel Products Co., Kansas, Mo., has just issued a particularly interesting catalog describing its various models of all-steel dumping bodies adapted to various types of contracting service.

STEEL CABS FOR MOTOR TRUCKS

The International Motor Co., 25 Broadway, New York City, is offering a new steel cab for installation on motor trucks. This outfit is described in detail in literature which may be secured free on request.

ROAD ROLLERS WITH SCARIFIERS

The Huber Mfg. Co., Marion, Ohio, which builds road rollers in either the single or the double cylinder type for steam operation with scarifier attachment, will be pleased to send its literature describing this outfit to interested contractors and road engineers.

COMPLETE STONE-CRUSHING AND QUARRYING OUTFITS

Contractors and quarrymen will be particularly interested in the new catalog K. A. U. just issued by the Good Roads Machinery Co., Inc., Kennett Square, Pa., describing its complete line of Champion rock crushers, elevators, screens, conveyors, portable stone bins, winding drums, dump-cars and rock drills.

PLACING GROUT WITH PNEUMATIC OUTFIT

The pneumatic grout mixers and placers, which were used so successfully on the New York City aqueduct, are described in detail in literature which may be secured from the Ransome Concrete Machinery Co., Dunellen, N. J.

WHEELBARROWS WITH REINFORCED NOSE

The extended nose brace which is a feature of Akron barrows, has met with great favor among contractors. Literature describing this important feature in extending the life of wheelbarrows may be secured from the Akron Barrow Co., Cleveland, Ohio.

CONTRACTOR'S FOUR-CYLINDER GAS ENGINE

The demand for a gasoline engine of higher horsepower than the usual Novo unit has led the Novo Engine Co., Lansing, Mich., to bring out its new Models AF and EF four-cylinder, four-cycle vertical type engines, which are described in detail in literature available to interested contractors.

METHODS OF STORING EXPLOSIVES

The literature of E. I. du Pont de Nemours & Co., Wilmington, Del., contains information regarding the handling of explosives with particular reference to the use of portable and permanent powder magazines.

Making Efficient Use of Clips on Wire Rope

IN order that clips may be correctly applied and the maximum of safety be attained in their use with wire rope, care must be taken to see that they are put on right. If the following rules for the use of Crosby clips, made by the American Hoist & Derrick Company, St. Paul, Minn., are observed, the clip will reciprocate by hanging on as long as the wire rope itself lasts and then be ready for the next rope.

Never cut a wire rope without winding both sides of the contemplated cut with wire. If this precaution is neglected, the strands will become untwisted and flattened. Of course, such a rope does not furnish a secure grip for the clip. Always use a thimble on the loop to protect the wire rope. On rare occasions, as when the rope is carried around a large post, the thimble may be dispensed with, but a good general rule is: Never clip a rope without using a thimble in the loop.

Always allow 30 diameters of the rope from the center of the loop to the wired end. To



FIGURE 1.—MEASURING TO ASCERTAIN PROPER LENGTH OF SHORT END

show how this works out: 30 diameters of a $\frac{3}{4}$ -inch rope will amount to a little more than 22 inches; 30 diameters of a $\frac{7}{8}$ -inch rope will equal a lap-over of 26 inches, and so on. This gives a good, safe short length and works out logically on the heavier ropes, which are hard to bend and manipulate.

After you have ascertained the proper length of the short rope, then wire the thimble to the bearing point of the loop, as illustrated in Figure 1. With the thimble wired in place, it is an easy matter to bend the loop around a short post or rod. It is good practice to wire the loop in place until the clips are securely applied. A simple method of doing this is illustrated in Figure 2.

The number of clips to be used at each loop should be governed by the maximum capacity of the rope rather than by the work it will be called upon to do. However, the fewest that should be used on running ropes is two at each loop, though it is better to put on an extra one. For guy ropes three clips should be placed at each loop. The following table shows the recommended number of clips for the various sizes of rope:



AN EFFECTIVE CLIP TO HOLD WIRE ROPE

Size rope, inches.....	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{7}{8}$	1	1 $\frac{1}{4}$	1 $\frac{1}{2}$
	—Number of Crosby Clips—					
Standard crucible steel hoisting rope.....	2	2	2	3	3	4
Standard plow steel hoisting rope.....	2	2	3	3	3	4
Big pull plow steel hoisting rope.....	2	2	3	3	3	4
Galvanized crucible steel guy rope.....	2	2	2	3	3	4

It is important that the "live" or long rope rest upon the broad bearing surface of the base of the clip, as the pressure of the U-bolt on the live rope would tend to cut it. Many installers make a practice of staggering the clips, that is, one with the base bearing against the "live" rope, the next with the U-bolt against the "live" rope, and so on. This is bad practice. Those who do it claim that it gives a more solid fastening, but this is doubtful. Any wire rope vibrates and whips about more or less while working, and if the U-bolts of the clips which fasten it are bearing against the live rope, their narrower bearing surface may in time produce a break. This would not occur if the base with its broad bearing area were resting against the live rope.

The clip farthest from the loop should be applied first at a distance approximately 4 inches from the wired end of the rope, which should be turned up tight when the clip is first put on. The clip nearest the loop should be put on next, 4 inches from the loop. If placed too close to the loop, it will shorten the bending angle of the rope, and the wires will be more in danger of fracture, yet it must not be placed so far away as to allow the thimble



FIGURE 2.—LOOP TEMPORARILY WIRED IN PLACE



FIGURE 3.—FIRST CLIP CORRECTLY PUT ON

to drop out. The nuts of this clip should not be turned tight when the clip is first put on.

If three clips are to be used, the third should be applied last, half-way between the other two. Before completely tightening these last two clips, it is necessary that some stress be placed upon the rope. This will take up the slack and equalize the tension on all three clips and is a very important operation. After this has been done, the last two clips should be tightened up thoroughly.

It will increase the efficiency of the installations of the clips if they are placed on the rope with reference to the lay. In a length of a



FIGURE 5.—THIRD CLIP CORRECTLY APPLIED

rope corresponding to about 25 diameters of the rope, a strand will make two complete twists around the hemp center. From the "crown" of one of these twists to the next is called a "lay." In a $\frac{3}{4}$ -inch rope a lay is $7\frac{1}{4}$ inches, but of course the number of inches in a lay varies with the size of the rope. When it is desired to use two clips only and place these on the crowns of one strand, a short end of 25 diameters will be

ample. If it is desired to use three clips and place them upon the crowns of one strand, it will be necessary to allow a short end of 35 diameters.

The clips should be put on perfectly straight. Any twists or crookedness will place the clip at a disadvantage and impair its holding power. The nuts must be tightened uniformly, each given a few turns alternately. Special care should be exercised when tightening up a clip where a heavy rope is used



FIGURE 4.—SECOND CLIP CORRECTLY PUT ON

and only an inch or so of the threaded U-bolt protrudes through the bolt holes.

It is a wise practice to oil the threads in both the bolt and the nut before tightening. This permits the clip to be screwed on more easily and securely and is an added protection against rust.

Even after the clips have been applied and tightened up properly, the tightening operation must be repeated after the rope is carrying a load. This is because heavy stress always slightly reduces the diameter of a rope.



FIGURE 6.—CLIPS PLACED ON CROWNS OF ONE STRAND

"Winter Discounts" on Materials

TO encourage early spring construction, A. P. Greensfelder, Chairman of the Committee on Methods of the Associated General Contractors, suggests that manufacturers and dealers adopt "winter discounts" on brick and other building materials purchased in January, February and March.

The principle is one long ago adopted by

other lines of merchandising to maintain an uninterrupted flow of business. Note the "white sales" in January and the "fur sales" in August, and the straw hat sales for ladies the year round. Why not in construction?

To lengthen the construction season by two months would increase the contractors' business $33\frac{1}{3}$ per cent.

Useful Information for Contractors

ONE thousand shingles, laid 4 inches to the weather, will cover 100 square feet of surface, and 5 pounds of shingle nails will fasten them on.

One-fifth more siding and flooring is needed than the number of square feet of surface to be covered, because of the lap in siding and flooring.

One thousand laths will cover 70 yards of surface, and 11 pounds of lath nails will nail them on.

Eight bushels of good lime, 16 bushels of

sand and 1 bushel of hair will make enough good mortar to plaster 100 square yards.

One cord of stone, 3 bushels of lime and a cubic yard of sand will lay 100 cubic feet of wall.

Cement, 1 bushel, and sand, 2 bushels, will cover $3\frac{1}{2}$ square yards 1 inch thick; $4\frac{1}{2}$ square yards $\frac{3}{4}$ -inch thick, and $6\frac{1}{4}$ square yards $\frac{1}{2}$ -inch thick.

One bushel of cement and 1 bushel of sand will cover $2\frac{1}{4}$ square yards 1 inch thick; 3 square yards $\frac{3}{4}$ -inch thick, and $4\frac{1}{2}$ square yards $\frac{1}{2}$ -inch thick.

—The Spout,

Personal Notes

Joe Long Joins Austin-Western Forces

The Austin-Western Road Machinery Company, Chicago, Ill., is fortunate in securing Joe L. Long, known throughout the country as a writer and speaker on highway development and administration, as the Sales Manager of the Motor Pick-up Sweeper Department. Mr. Long was the founder, and for several years editor, of *The Road Maker*, and since severing his connection with that publication has devoted a large share of his time to highway campaigns.



JOE L. LONG

Duff Becomes Secretary of National Paving Brick Manufacturers Association

Edward E. Duff, Jr., who has recently been elected Secretary of the National Paving Brick Manufacturers Association, Engineers Building, Cleveland, Ohio, will assume his duties on or about January 1. Maurice B. Greenough, the retiring secretary, will become associated at that time with W. M. Lasley of Chattanooga, Tenn., in various enterprises, including the manufacture of paving brick.

Mr. Duff was for several years in railroad work for the Pennsylvania Railroad, after which he was engaged in municipal engineering



EDWARD E. DUFF, JR.

and management at Sewickley, Pa. During the war he served for two years with the A. E. F. in France as captain of engineers. For three years Mr. Duff was field engineer for the Eastern Paving Brick Manufacturers Association. He is a graduate of the Department of Civil Engineering, Carnegie Institute of Technology, is an associate member of the American Society of Civil Engineers, and a member of the American Society for Municipal Improvements and other technical societies.

B. Ashburton Tripp

B. Ashburton Tripp, 730 Guardian Building, Cleveland, Ohio, was recently chosen as the landscape architect for the new Moreland Courts Development, Cleveland, Ohio. This is a \$30,000,000 apartment housing development with stores, theater, markets and garage center in connection. Alfred W. Harris, of Cleveland, is the architect. The foundations for thirteen 100-foot units are already in, several units are up in steel, and one is nearing completion in masonry. This development will be almost a complete city in itself.

Wickham Has Resigned

Frank A. Wickham resigned his position as General Manager of the Glide Road Machine Company, 501 Huron Street, S. E., Minneapolis, Minn., the middle of September.

Explosives Dig Cellar at Police Headquarters

Unusual Care Makes Use of Dynamite Possible in Excavating Basement Under Existing Building

ONE of the cellar improvements planned when a police station was being remodeled in Trenton, N. J., was a good-sized furnace pit. When the workmen started to dig it, they encountered a ledge of rock which proved to be granite of the same quality as that found in a ledge of rock near Princeton, N. J. A cubic foot of this rock weighs 110 pounds and it is said to be ten times as hard as ordinary granite. In fact, it takes 49,000 pounds pressure to the square inch to break it.

work by setting off one heavily-loaded charge. Instead, the ledge was reduced section by section by firing comparatively light charges, and before each blast heavy railroad ties were placed over the rock to prevent flying pieces from causing damage. The first charge was fired while men were working on the building and the police officers were in their quarters. Little noise accompanied the explosion. Some of the workmen knew nothing about the blast until laborers began to carry the broken bits of rock from



THE PIT IN THE CELLAR AT POLICE HEADQUARTERS, TRENTON, N. J., DUG BY USING 1½ CASES OF DU PONT DYNAMITE

Workmen with hand tools tried to drill through the granite without success. The hard, unyielding rock resisted every effort made to remove it by hand labor. Then a local contractor, Fred B. Johnson, who has had considerable experience in the use of dynamite, was called in to solve the problem. It was a difficult one, for the ledge of rock supported two pillars and one wall of the building. The workmen expressed a belief that dynamite could not be safely used, as the explosions would undoubtedly weaken the structure. However, two electric light bulbs were placed over the rock, a steam drill was brought in and holes were bored for the explosive charges.

No attempt was made to accomplish all the

the basement. The Du Pont dynamite performed its work without the slightest damage to the building. A 3-inch cast iron water-main above the pit remained intact. Even the electric light bulbs survived the shock.

Other bore holes were drilled, loaded and fired. One of them was within a foot of the rear wall. No damage resulted to the structure, although the rock which it was intended to remove was smashed to bits. In this way, a pit 16 feet square was blasted to a depth of 8½ feet.

The accompanying illustration shows the scene of operation after approximately 100 tons of rock had been moved with 75 pounds of Du Pont dynamite.

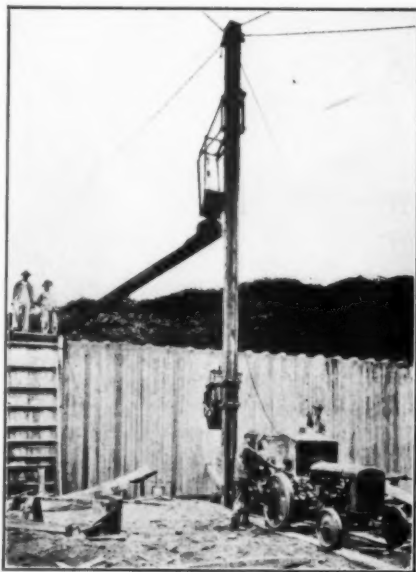
The contact between the engineer and the contractor should always be one of mutual confidence and cooperation.

Novel Use of Mast Chuting Equipment

THE development of the use of mast chuting equipment on small jobs has been exceedingly rapid. It was only a year or two ago that contractors felt that chuting equipment was meant solely for the large job. With the development of the Insley mast hoist bucket, made by the Insley Manufacturing Company, Indianapolis, Ind., however, there has been a rapidly increasing use of this method of placing concrete.

The A. A. Lane Construction Company, Cleveland, Ohio, recently handled an interesting job in the construction of retaining walls, where an Insley mast hoist bucket was used with a Ford tractor supplying the power. A. A. Lane, President of the A. A. Lane Construction Company, states that in the constructing of retaining walls and similar work where the volume of concrete is not large enough to warrant erecting a tower and chuting, the Insley mast provides a very economical way of placing concrete.

The wall illustrated herewith is 16 feet in height above the foundation, 20 inches thick at the base, and 12 inches thick at the top. The wall



**INSLEY MAST HOIST BUCKET AS USED BY
A. A. LANE CONSTRUCTION COMPANY**

is about 400 feet long and was used to surround a cold storage bin. Forms were erected for approximately 50 feet of wall, and this amount was poured each alternate day during the progress of the work. The hoisting was done with a Fordson tractor with hoisting drum attached to the rear end and driven by the tractor motor. The tractor was also used for moving the mixer and the other equipment. The average time of pouring one section of the wall was about 2½ hours. Concrete was mixed in a Koehring Dandie mixer of one-bag capacity. The cost of placing the concrete for this equipment was very satisfactory.

Ransome to Enlarge Plant Again

THE increased volume of business in the paving and small mixer field has necessitated a further enlargement of the manufacturing plant of the Ransome Concrete Machinery Company, Dunellen, N. J. The floor space of this plant was doubled about one year ago, but the steady increase in building activities has made it necessary to add a one-story structure with mmoitor roof to be built of concrete and steel, covering a ground area of nearly 10,000 square feet.



**BUILDING THE ROSATI-KAIN HIGH SCHOOL,
ST. LOUIS, MO.**

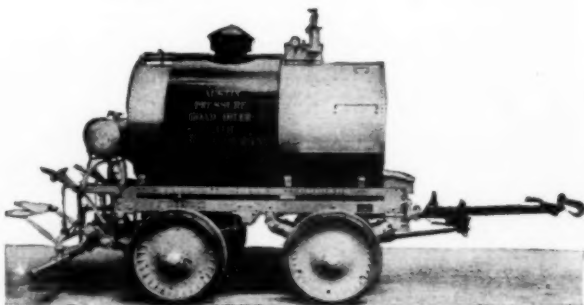
The Insley mast hoist used by the contractors, the John Grewe Construction Company, St. Louis, was sold by the George F. Smith Company, St. Louis



A Pressure Road Oiler Mounted on a Trailer

A PRESSURE road oiler which has certain advantages over horse-drawn and motor truck pressure oilers has been developed by the Austin - Western Road Machinery Company, 400 North Michigan Boulevard, Chicago, Ill. This trailer oiler can be pulled by either a truck or a tractor and consequently does not tie up so large an investment in a single machine as the oiler unit mounted on a motor truck. It retains the high-speed feature of the truck type, which is very desirable when the work of oiling is being done some distance from the source of oil supply. There is a certain speed beyond which oil cannot be applied successfully, but on the run to and from the base of supply the trailer saves much valuable time.

Trailer oilers are arranged for rear control, the only outstanding difference between those mounted on motor trucks and the trailer units being that the pump on the trailer oiler is driven from the rear wheels, as in the case of horse-drawn machines. The trailer oiler is



HANDLING ROAD OIL BY TRAILER

furnished in two sizes, with tank capacities of 750 and 1,000 gallons. The oiling unit is substantially constructed, having a tank riveted in the same manner as locomotive boilers and fitted with baffle plates. The truck trailer is of the heavy-duty type that is always used where working conditions are unusually severe. It has a strong and heavy frame, roller bearing wheels and special springs. These outfits are so arranged that the complete oiler units can be removed from the trailer chassis without difficulty at the end of the oiling season and the latter used for other purposes if desired.

What Is a Fair Allowance for Incidentals?

THE determination of a fair percentage allowance over net costs to provide for incidentals in connection with force account work where the cost of labor and insurance only is allowed, in order to permit a contractor to realize the 15 per cent profit named in the specification, has been left to the Associated General Contractors upon common agreement between a member of the association and the chief engineer of a flood-control dam.

The facts of the situation are that the contractor has a contract for the construction of the flood-control dam, but, owing to indefinite foundation formations, the work involves considerable force account, which is to be paid for by the Control Board, and the cost of which is to include all necessary expenses connected with it. On account of the large cost of incidentals, the 15 per cent allowance is not adequate. It has been common practise to allow the contractor a carrying charge to cover the cost of maintenance of men, including such details as loss on boarding-house, cots, mattresses, tent depreciation, water-supply, transportation, etc., and the contractor in the past has been allowed 10 to 25 per cent to meet

these expenses. At the present time they are located twenty-five miles from town on the desert, where the water-supply is very costly.

The preliminary opinion of the A. G. C., acting as referee, is based on the assumption that the work being done on the main contract is small in comparison with the force account work on the foundation, and that under these conditions the fair and usual procedure would be to separate the field overhead expense in relation to volume of contract work and force account work as indicated by the pay-roll. If the pay-roll was running \$3,000 a week, and \$1,000 was indirect expense and the balance was proportioned equally between the contract and the force account work, the fair and equitable distribution would be 50 per cent on the overhead force account work, and 50 per cent for contract work.

On such items as distribution of camp outfit, plant, etc., a monthly figure can be worked out by estimating that the camp and equipment will last only the life of the job. For instance, if the contract is to last a year, $8\frac{1}{2}$ per cent should be charged off monthly, and a proportion of this charged to force account work, based on the ratio of the pay-roll. For the



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The "Caterpillar's"* field of usefulness is by no means limited to engineering and construction projects. There is a "Caterpillar"* of size and capacity for every power need. On farm or ranch, in the mining, oil and lumber industries, for snow removal and other civic work—wherever tractive power and endurance are at a premium, the "Caterpillar"* has no real competitor.

At Dakota City, Nebr., the Woods Bros. Construction Co., of Lincoln, is finding "Caterpillar"* Tractors indispensable for snaking trees to the bank of the Missouri River where current retards are being built. A 5-ton "Caterpillar"* drags the untrimmed trees through the heavy underbrush to a convenient roadway. Here the trees are bunched, loaded on a special two-wheel cart and hauled by a 10-ton "Caterpillar"* two or three miles to the river. The tractors work day and night, averaging 20 hours out of 24. Superintendent of the job, L. A. Day, says: "Not only is the cost of tree hauling with "Caterpillars"* approximately one-half that of operating with horses, but "Caterpillar"* power saves up to \$100 every time we have to move our hoisting engine. And we move it about every ten days." On reclamation, road building, logging and engineering projects of all kinds the "Caterpillar"* is invariably selected as the ideal power for speeding up the work and cutting costs.

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plant, the average charge for its use, depreciation, etc., should be 4 per cent per month of the original cost of the machine.

From the incomplete information given, the

opinion of the referee is that the actual cost of overhead and indirect expense will run from 15 to 20 per cent of the direct labor and material cost.

Average Rentals of Construction Equipment

Computed from A. G. C. Schedule by Master Builders' Association of St. Louis, Mo., for That City

Adding and listing machines.....	\$0.25
Automobiles, passenger.....	1.00 per cylinder
Automobiles, trucks.....	4.00 per ton
Backfiller, power-driven.....	7.50
Barges.....	0.50 per 100 sq. ft.
Boiler and 3-drum hoisting engine.....	0.25 per H.P.
Boiler and 2-drum hoisting engine.....	0.225 per H.P.
Boiler and 1-drum hoisting engine.....	0.20 per H.P.
Boiler only.....	0.10 per H.P.
Boring machine, wood.....	0.50
Bucket, tippie and bottom dump.....	0.02 per cu. ft.
Bucket, clam.....	0.10 per cu. ft.
Bucket, orange peel.....	0.15 per cu. ft.
Cableways, without power.....	0.61 per lin. ft.
Cars, skip, wood.....	0.25 per cu. yd.
Cars, steel, 1 yard and smaller.....	0.02 per cu. ft.
Cars, wooden, side dump.....	0.25 per cu. yd.
Cars, standard freight.....	0.05 per ton capacity
Cars, steel, side dump.....	0.05 per cu. yd.
Compressor, air, steam-driven.....	0.06 per cu. ft.
Compressor, without power.....	0.04 per cu. ft.
Compressor, portable, with power.....	0.10 per cu. ft.
Counterweight drum.....	1.00
Crusher only.....	1.00 per ton hr.
Crusher, with elevator and screen.....	1.50 per ton hr.
Cutter, bar, portable, with power.....	3.00
Derrick, wooden, without cable.....	0.05 per ft. boom
Derrick, steel, without cable.....	0.08 per ft. boom
Derrick, traction, with power.....	0.60 per ft. boom
Derrick, breast.....	0.50
Derrick, circle swing.....	0.60
Drill, rig, portable.....	10.00
Drill, small air.....	1.00
Drill, steam.....	1.50
Drill, Duntley electric.....	2.00
Elevator, platform or bucket.....	0.50
Elevators, with hopper for concrete.....	0.05 per cu. yd.
Engine, skeleton, 3-drum.....	0.15 per H.P.
Engine, skeleton, 2-drum.....	0.125 per H.P.
Engine, skeleton, 1-drum.....	0.10 per H.P.
Engine, steam or gas.....	0.15 per H.P.
Engine, derrick swinging.....	1.00
Engine, traction.....	20.00
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Grader, belt, elevating.....	10.00
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Leveling instrument, engineer's.....	0.50
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Mixers, with power and side loader.....	0.30 per cu. ft.
Mixers, with power.....	0.25 per cu. ft.
Mixers, without power.....	0.20 per cu. ft.
Motorcycle.....	1.50
Motors.....	0.10 per H.P.
Motor boats.....	0.50 per H.P.
Pile driver leads.....	0.05 per lin. ft.
Pile hammers, steam.....	0.02 per cwt. ram
Pile hammers, drop.....	0.003 per 100 lbs.
Pumps, centrifugal, belt-driven.....	M. Gal. hr.
Pumps, centrifugal, with power.....	M. Gal. hr.
Pumps, duplex and triplex.....	M. Gal. hr.
Pumps, pulsometer.....	M. Gal. hr.
Pumps, diaphragm, hand.....	0.50
Pumps, diaphragm, with power.....	1.50
Plow.....	0.50
Rail bender.....	0.30
Roller, horse or hand.....	1.00 per ton
Roller, power.....	2.00 per ton
Road machine.....	1.00
Saw, no power.....	1.00
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Scraper, Fresno.....	0.50
Scraper, slip.....	0.25
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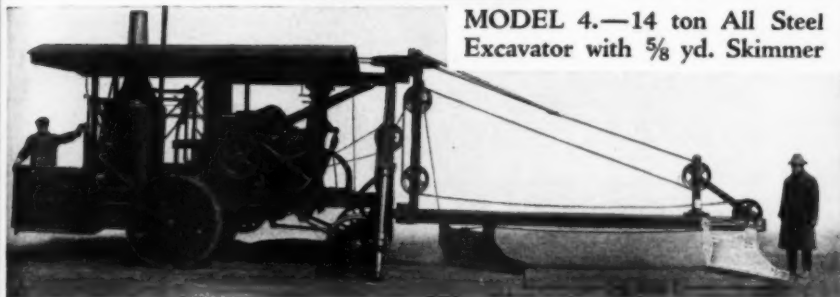
Above rates are per calendar day (exclusive of holidays) based on one shift per day, and are exclusive of transportation, crew, fuel, lubricants and supplies. Minimum time of rental 30 days for power equipment not listed above, at 6 per cent of its value per month.

Fall Highway Lettings Necessary

THE ideal way for road work to be let is to hold the letting in the late fall or early winter, which would then provide considerable preliminary work which could be done during cold weather. One large construction company in Kansas has just obtained a contract in its own county for 15 miles of 18-foot brick road which should have been let last December. They could have lined up with materials on the ground and have been ready to start actual construction on April first. This contract was let April 21, and with lots of crowding they could not hope to begin actual laying of the

pavement until June 1. If they could have secured the contract in the fall, it would have practically eliminated the overhead expense of winter. Last winter this company had no large contracts on hand and it cost them \$30,000 to keep their organization together. This is the first time for seven or eight years that this has happened, but it shows clearly how expensive a winter with no work can be. About the only way to eliminate this unnecessary overhead expense to the contractor is to get a new contract late in the fall so as to have preliminary work to do during the winter months.

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MODEL 4.—14 ton All Steel Excavator with $\frac{5}{8}$ yd. Skimmer

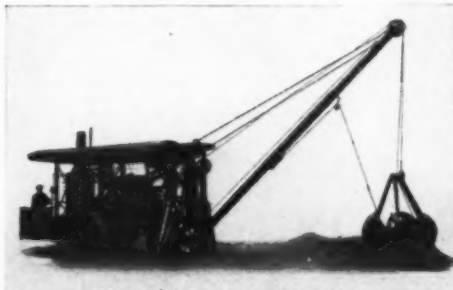
The KEYSTONE is a highly versatile traction steam shovel with all the efficiency of specialized design, usable with three different interchangeable scoops—*Skimmer, Ditcher and Clam Shell*—for Road Grading, Trenching, Back-Filling, Cellar Digging, Pit Mining, Loading, Unloading and Handling Materials. Can be equipped with electric motor drive for use in buildings. Saves first cost, moving cost and upkeep and is readily sold or rented for any sort of excavation job. A reliable road shovel of remarkable adaptability to other uses.

The heavy Keystone Skimmer Bucket, $\frac{5}{8}$ yd. capacity, has a horizontal crowd of 14 feet and fills itself at one shot in a six inch cut. It leaves a smooth surface, finished to grade and thus dispenses with costly hand-trimming. Shallow digging in hard material—old macadam, paving blocks, concrete and asphalt—is keystone work.

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Model 4, with Boom extension and $\frac{1}{2}$ yd. Clam Shell Bucket

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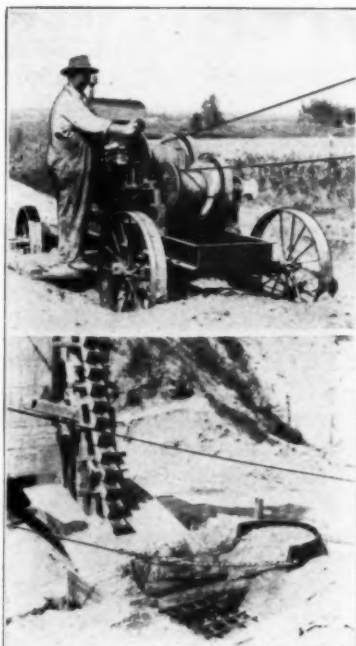
A New Portable Power Scraper Outfit

TO meet the requirements of the small contractor, or the county road commissioner who is handling only a limited quantity of material and wants to utilize a local sand and gravel deposit, a new type of portable drag scraper outfit has been placed on the market by Sauerman Brothers, 1143 Monadnock Building, Chicago, Ill.

The new outfits are equipped with "Crescent" type power scrapers, which are especially suited for use with a light power unit, as they are easy to pull and travel straight. The double drum hoist is furnished with a gasoline engine direct-connected, or can be arranged for belt drive from tractor or other motive power. The truck frame is of heavy steel channel construction mounted on broad tread, grooved steel wheels with steel axles.

Any laborer on the job can operate this portable scraper outfit. One man handles the entire operation through two levers placed side by side. There is nothing for a second man to do, as the scraper has only to be dragged back and forth, loading and dumping being accomplished automatically at the will of the operator. The front drum of the hoist operates the load cable, which leads through a sheave from the drum to the bridle chains on the front of the scraper. The pull-back cable leads from the rear drum through another sheave on to a guide block at the far end of the excavation and then is attached to the rear bridle chains of the scraper.

The entire outfit can be made ready to move in a jiffy, and in less than an hour after arriving at a new location it can be put into operation. In moving from one set-up to another, the cables are simply wound up on the drums, the bridle cable disconnected, the scraper and blocks put on the truck, and the whole outfit hooked up to a tractor, motor truck or team and pulled out. At the new location the wheels of the power unit are sunk into the ground, the bridle cable connected to new stakes or dead-



PORTABLE SCRAPER UNIT

Upper view shows gasoline engine driven power unit of Sauerman portable scraper outfit. Lower view shows scraper delivering sand and gravel to foot of bucket elevator of small screening plant

men, the guide blocks located, cables hauled out, scraper bucket hooked on, the engine started—and the outfit is working.



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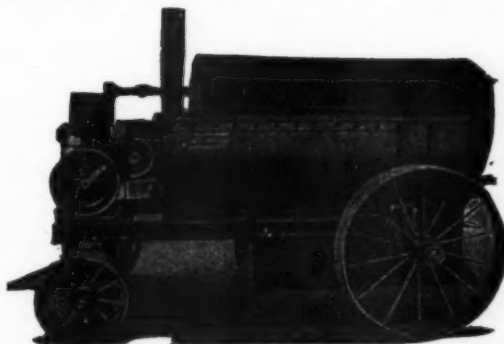


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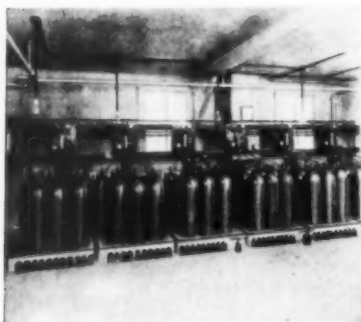
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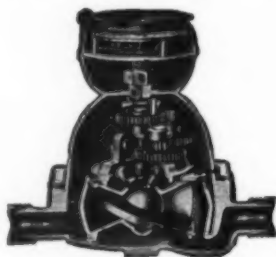
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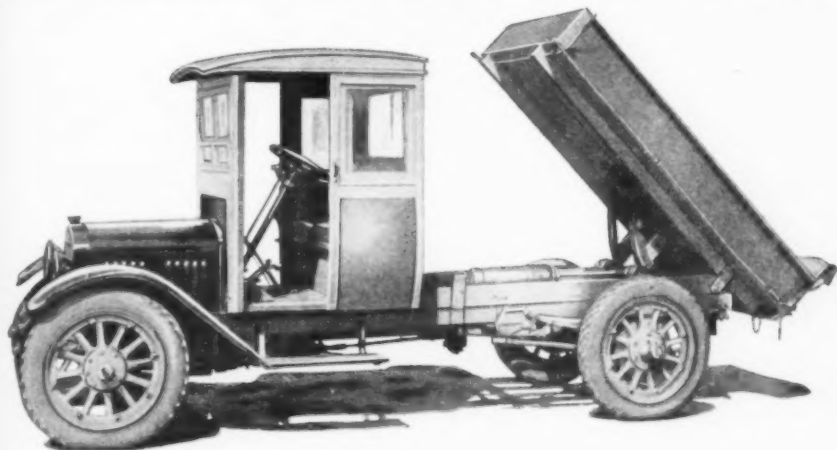
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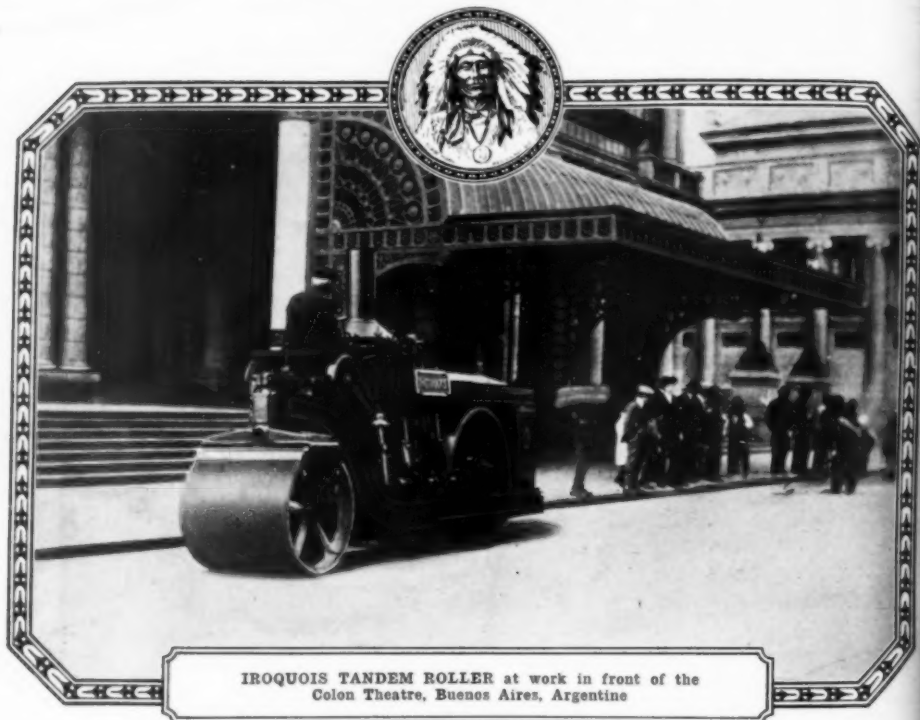
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